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Pilots Handbook

Gyroplane Type MTOsport (UK spec only)

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Applicability

Aircraft Registration:	**G-**
Aircraft serial no.	**RSUK/MTOS/**
Engine type:	**Rotax 912ULS or 914UL**
Engine serial No:	
Rotor blade type & diameter:	**Autogyro 8,4m Rotor system (black end-caps)** **or** **Autogyro 8,0m Rotors system (grey end caps)** **or** **Autogyro 8.4m RotorSystemII (red caps only) when modified under SB-040**
Propeller type:	**HTC 1,73m or Woodcomp SR3000/3 (option)**

NOTE!

This autogyro may be operated only under adherence to the operation limits and the information contained in this manual. The manual should be carried on board the aircraft.

The manual is not a replacement for theoretical and practical training as to how to operate this machine. Failure to adhere to its provisions or to take proper instruction can have fatal consequences

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AMENDMENTS CONTROL PAGE

1. Where & when necessary RotorSport UK Ltd (hereafter referred to as RSUK) will issue updates to this maintenance standard, and will notify known owners to review the changes via the RSUK website with changes appropriately identified by a strike in the margin.
2. Aircraft operators are responsible for ensuring that amendments to their publication are carried out immediately and in accordance with instructions contained in amendment transmittal letters (where issued).

ISSUE NUMBER	DATE	INSERTED BY	ISSUE NUMBER	DATE	INSERTED BY
Initial			14		
1	03/12/08		15		
2	20/03/09		16		
3	21.12.09		17		
4	17.12.10		18		
5	12.9.11		19		
6	02.04.12		20		
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8			22		
9			23		
10			24		
11			25		
12			26		
13			27		

Issue	Change summary
3	Woodcomp SR3000/3 propeller and Smart Avionics controller option added.
4	MC and SB changes incorporated to date, further Rotax information added
5	Best glide speed/text amended. Conair Sports SSM incorporated RotorSystemII incorporated. OEM stick grip incorporated. Mods referred to RSUK website. ATR833 radio and Aveoflash strobes added.
6	Section 7 Comment on sunlight and damp storage conditions (p60)

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RotorSport UK Ltd approval signatures for this Pilot Handbook	
Signature: Gerry Speich Jun 6 2012 12:34 PM CoSign	Signature: Graham Shaw Jun 6 2012 2:02 PM CoSign
Position: Test Pilot & Eng. Manager	Position: Flight Test Observer & Inspector

(signatures on master copy)

GENERAL INFORMATION

1.1 INTRODUCTION

This manual is provided to give pilots and instructors information which contributes to the safe and efficient operation of this autogyro.

It also contains basic information from the aircraft manufacturer, as well as the legal basis for flight.

Pilots of this aircraft must hold an appropriate type licence, with type conversion training by an authorised instructor.

Pilots must make themselves familiar before flight with the special characteristics of this autogyro. You are obliged to read both this pilots manual and the maintenance manual to ensure you are familiar with all equipment and aircraft structure/engine.

1.2 AUTHORITY FOR FLIGHT WITHIN THE UK

The legal basis for the operation of this MTOsport autogyro is regulated in the Airworthiness Approval Notification (AAN29247), issued by the Civil Aviation Authority (CAA). It has been shown to comply with the requirements of BCAR Section T issue 3, and is considered as a factory built aircraft.

It is supplied by RotorSport UK Ltd.

The aircraft is equipped and permitted for daytime VFR flight only.

1.3 EXPLANATIONS AND SENSIBLE SAFETY MEASURES

The manual is not a replacement for theoretical and practical training on the operation of this machine. Failure to take proper instruction can have fatal consequences.

The following definitions are used in this manual with warnings, precautionary measures and remarks. Their sense and their meaning are described as follows.

WARNING: means that the neglect of the appropriate procedure will result in a direct or critical reduction of flight safety.

NOTE: means that the neglect of the appropriate procedure will lead, on a longer time base, to a reduction of flight safety.

REMARK: stresses the attention for a special circumstance, which does not affect safety directly, but is still important.

PRECAUTIONARY & SENSIBLE SAFETY MEASURES

Before flight pilots should familiarise themselves with the appropriate navigational, weather and safety information pertinent to their planned route.

Flight in severe turbulence is prohibited.
Flight near thunderstorms is prohibited
Aerobatics and manoeuvres resulting in reduced "g" are prohibited
Smoking in the aircraft is prohibited

The choice, selection and use of this particular aircraft for the purpose chosen is at the sole discretion and responsibility of the owner/pilot. RotorSport UK Ltd takes no responsibility for your decision to fly.

In common with other aircraft of this type the MTOsport utilises a non-certified engine. This means that there may be a higher risk of engine failure than in a certified aircraft, with the associated risks of damage or injury as the result of an unplanned landing. Therefore strict compliance with the engine manufacturer's maintenance schedules, operational procedures and any additional instructions which may be given to you by RotorSport UK Ltd, on behalf of the engine supplier, is essential. The aircraft must always be flown with the risk of engine failure in mind, and must not be flown over any areas where a forced landing can not be safely executed.

1.4 AIRCRAFT DESCRIPTION

Characteristics:

- Autogyro with nose gear wheel chassis
- Airframe manufactured from inert gas welded stainless steel tube
- Two-seat tandem configuration
- GRP spring spar mainwheel undercarriage
- Main wheels fitted with hydraulic disc brakes (front seat operation)
- Extruded aluminium rotor
- Rotor head controlled with connecting rods
- Rudder controlled via cable
- GRP or optional carbon fibre fin, rudder and horizontal stabilizer
- Engine four-stroke flat-four Rotax 912 ULS or optional Rotax 914 UL
- Three-blade ground-adjustable 1.73m diameter HTC propeller or Woodcomp SR3000/3 variable pitch propeller

TECHNICAL DATA (see also fig. 1)

- Rotor diameter: 8.40m or 8.0m.
- Length: 5.08m
- Height: 2.65m
- Width: 1.82m
- Rotor blade profile: NACA 8H12
- Empty weight: 250 kg nominal (see individual aircraft load sheet for specific version weight)
- Payload: 250 kg nominal (see individual aircraft load sheet for specific version weight)
- Take-off mass (max.): 500 kg.
- Fuel tank capacity: 35 ltrs or 70ltrs with optional second tank

1.5 PICTORIAL VIEWS OF THE MTOsport

View from the rear

View from the left hand side

Figure 1: View from in front

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2. OPERATIONAL LIMITS

2.1 INTRODUCTION

This section defines the limit values for safe operation of the MTOsport autogyro. It contains the operation limits established during flight testing, as well as limit values established by test or computation. The existing instrument placards are described.

Recommended aircraft operational temperature limits -25 degC to +50degC.

SPECIFIC LIMITATIONS AS PER THE CAA AIRWORTHINESS AUTHORISATION NOTICE

These limitations are mandatory, and are directly copied out below.

6. Conditions Affecting This Approval

6.1 Aerobatic Limitations

Aerobatic manoeuvres are prohibited
Intentional spinning is prohibited
Manoeuvres involving a deliberate reduction in normal 'g' shall be avoided

6.2 Loading Limitations

Maximum Total Weight Authorised:	*500kg*
Maximum Empty Weight	*303 kg (914UL) 301Kg (912ULS)*
Maximum Pilot Weight front seat	*125 kg*
Minimum Pilot Weight front seat	*60 kg*
Maximum Occupant Weight rear seat	*120 kg*

Front seat occupants under 60 kg weight must carry suitable ballast

6.3 Engine Limitations

Maximum take-off (max. 5 minutes)	*5800 rpm*
Max. continuous	*5500 rpm*
Max. CHT	*135ºC*
Min. oil temp.	*50ºC*
Max. oil temp.	*130ºC*
Min. oil pressure	*0.8 bar*
Max. oil pressure	*7 bar*
Max manifold air pressure (take off)	*39.9in Hg (914UL) (no restriction for 912)*
Max continuous manifold air pressure	*35.4inHg (914UL) (no restriction for 912)*

Note – 914UL manifold pressure overshoot is allowable, but must be within parameters within 2 secs
(MAP limits only apply where a Woodcomp VP prop is installed)

6.4 Air Speed Limitations

Maximum indicated air speed	*120mph, 104kts (IAS)*

6.5 Other Limitations

The aircraft shall be flown by day in visual meteorological conditions only.
Flight in icing conditions is prohibited (not placarded)
Flight in strong gusty winds or wind velocities of more than 45mph (40 kts) is prohibited. (not placarded)

Other Aerobatic Limitations
Intentional spinning is prohibited.
Aerobatic manoeuvres are prohibited.
Manoeuvres involving a deliberate reduction in normal 'g' shall be avoided**.**
Maximum bank angle 60 degrees from vertical
Flight in icing conditions is prohibited.
VMC (Visual Meteorological Conditions) only.
This aircraft shall be flown by day and under Visual Flight Rules only
Ensure you read your *CAA Operational Limitations* (part of the Permit to Fly) for exact limitations of your aircraft.

2.2 AIRSPEED
The values below are indicated speeds (IAS) measured via the ASI metering hole, centrically located in the fuselage nose.

V_{NE}	Maximum speed	120 mph
V_{climb}	Best climb speed	65mph
V_A	Manoeuvre speed	50mph
$V_{Approach}$	Approach speed.	70mph (1^{st} stage) 55mph (final)
V_T	Max speed in turbulence	70mph
	Best glide speed (for maximum range)	60mph
	Min rate of descent speed (min height loss)	40mph

WARNING! The maximum speed V_{NE} must be never exceeded!

2.3 AIRSPEED INDICATOR MARKS

- Green range (normal range) from 0-50mph
- Yellow range (caution, especially nearing Vne) from 50 to 120mph
- Red line (V_{NE}) at 120mph

2.4 ROTOR
Once airborne, the rotor will maintain and manage its rotational speed to match the load exerted on it. An rpm gauge is provided to enable the pilot to easily see the rpm whilst pre rotating and making ready for take off, and as an in flight monitor.
Gauge markings:
0 to 200, amber. Take care in this range, bad handling can result in blade flap at low rpm.
200 to 550rpm, green. Full power can be applied in take off from 200rpm. Normal flight range depends on loading, see 5.1, performance data.
550 to 610rpm, amber. In this range the aircraft is pulling in excess of 2.3G. Fly with caution!
610 rpm red line. Do not exceed. Estimated in excess of 3G loading.

2.5 ENGINE

Manufacturer:	Bombardier Rotax, Gunskirchen/A
Type:	Rotax 912 ULS or Rotax 914UL
Take-off power:	100 HP/5800 rpm (5 minutes max operation) for 912ULS, 115HP/5800 rpm for 914UL (5 mins max operation)
Continuous duty (max):	90 HP/5500 rpm for 912ULS, 100HP/5500rpm for 914UL
Cylinder head temperature:	max. 135 °C
Oil temperature:	max. 130 °C
Propeller:	HTC 3 blade. Pitch angle: 19.5deg 912ULS, 20.5deg 914UL (ground adjustable to suit engine and working environment). Note that due to the concave face of the propeller measuring this angle is difficult. Propeller is pitched for max ground rpm of 5700. Alternative is Woodcomp SR3000/3 variable pitch propeller.

For further data refer to the engine manual and parts catalogue.

WARNING! The engine must not be run without the propeller fitted – doing so may result in severe engine damage.

2.6 ENGINE INSTRUMENTS

The following engine values are placarded on (or adjacent to) the instruments:
Note that, other than the engine rpm, the gauges are marked with these values internally.

	Range	**Maximum value**	**Unit of measurement**
Engine RPM	Green 1600 - 5500	Amber 5500 - 5800/5min, red line 5800.	Rpm
Oil temperature	50 - 130	130 red line	°C
Cylinder head temperature	to 135	135	°C
Oil pressure	0.8bar min to 3,500 rpm, 2-5bar above	7 (cold weather starting)	Bar

2.7 WEIGHT & BALANCE

The maximum take-off weight (MTOW) of the MTOsport is 500kg. Marked on the aircraft, and on the aircraft AWC, is the *actual* aircraft empty weight with minimum required equipment. The Payload is the MTOW minus the empty weight, and represents the allowance available for occupants, fuel and luggage.

If any accessories are fitted which increase the empty weight of the aircraft then the aircraft's maximum payload must be reduced accordingly.

The pilot is responsible for ensuring the aircraft is not flown overweight.

NOTE! Flying the aircraft overweight invalidates your Permit to Fly.

The maximum permissible positions of the centre of gravity may not be exceeded.

The centre of gravity of the aircraft type was determined during Section T Compliance evaluation. The envelope operational extremes were evaluated and shown to be satisfactory. However operation outside of these evaluated points is not permitted!

Evaluation recorded that the approved envelope extremes (with maximum 10kg baggage in the rear passenger footwell or the nose locker) are:

Most Forward limit - 125pilot, 90Kg pass, min fuel, 10Kg rear footwell luggage – 600mm forward of mainwheel axle
Most Rearwards limit - 60Kg pilot, min fuel – 343mm forward of mainwheel axle
Most Highest limit - 60Kg pilot min fuel – 930mm above mainwheel axle
Most Lowest limit - 125Kg pilot, max fuel, 10Kg rear footwell luggage - 770mm above mainwheel axle

Vertical CG position (z) is relative to the wheel axle plane drawn between the main and nose wheel.
Longitudinal CG position (x) is fore or aft of the mainwheel axle plane (positive forwards).
The weight and balance report (AWC) supplied with the aircraft shows the Empty Weight and CG envelope calculated for that specific aircraft, with options supplied as new. Empty weight means aircraft containing minimum flight accessories and minimum fuel.
The report also shows, for reference, the thrust line offset.

WARNING! Care must always be taken when flying at extremes of the operational envelope.
WARNING! The nose luggage locker has a maximum loading of 10kg. If fully loaded, then the front seat loading limit is reduced to 110kg.

Maximum occupant weight in the front seat = 125 kg
Maximum occupant weight in the rear seat (with a 60kg front seat occupant) = 120kg
Minimum occupant weight in the front seat = 60 kg
Front seat occupants under 60kg body weight must carry ballast.

Remember - Fuel loading permissible is 500kg minus occupant weight, minus aircraft empty weight, minus any baggage or items added to the aircraft since weighed. Aircraft empty weight is placarded. Fuel mass is 0.72kg/ltr.

Example: 500Kg – 255Kg (empty wt) – 90Kg (rear seat occupant) – 90Kg (pilot) – 5Kg (luggage locker) – 10Kg (rear seat luggage) = 50Kg. Useful fuel load is 50/0.72 = 70ltrs.

Maximum possible fuel load is 70ltrs, 50.4Kg

If ballast is required to meet the minimum front seat loading condition of 60Kg, then it should be in the form of thin lead sheet placed behind and under the pilot seat cushion.

Carrying of bags or other items inside the aircraft is not recommended due to the presence of control cables and linkages. If used, ensure there is no control obstruction! Bags fitted into the rear seat must be securely attached to the seat harness, and included in the weight/balance calculation.

WARNING! The rear seat harness must be fastened correctly around the seat in single seat operation. DO NOT leave loose behind the seat, it may entangle with the rotor controls and prevent correct function!

A small detachable bag is fitted inside the aircraft. Its purpose is to carry the rotor tie down strap and basic aircraft documents only.

2.8 FUEL

The engine manufacturer recommends unleaded gas station premium fuel (MOGAS). AVGAS 100LL can be used, although not recommended for long term operation, as the lead in the fuel causes excess plug fouling and problems with the slipper clutch – refer to the engine manual for further information.

MOGAS should not be used if the fuel temperature exceeds 20°C or at altitudes above 6000ft due to the increased risk of vapour bubble formation in fuel lines. In these conditions AVGAS 100LL should be used.

Whilst refuelling:

1. Ensure that the fuel is clean and water-free.
2. Always use a filter when refuelling, preferably with a water trap
3. Ensure the aircraft keyswitch is OFF before commencing refuelling
4. If refuelling on the port (LH) aircraft side, adjacent to the electrical passenger switches, take care not to spill fuel on the switches. If a spillage occurs, mop up quickly and leave to evaporate totally before turning electrical system back on.
5. Ensure filler caps are tight after refuelling, and any spillage in the base of the aircraft drained/mopped up pre flight.

The balance pipe between the two fuel tanks (where two are fitted) is not capable of transferring fuel from tank to tank at the same rate that fuel can be input to a tank; it may take several minutes for a full tank to equalise levels with an empty one. If it is required to refill both tanks at a fast rate, then fill one tank first, then the other, and top up either as required.

Before flight, use the water drain points under each tank to ensure the fuel is water free.

Warning! The fuel pickups are located at the front and rear of the left fuel tank. The primary fuel pump (mechanical on the 912ULS and keyswitch electrical on the 914UL) are connected to the front pickup, such that in a nose down descent at low fuel levels the maximum usable fuel is made available. A high nose up attitude at low fuel levels may uncover the front pickup, so ALWAYS turn on the secondary pump when low on fuel, recommended at 10ltrs or less.

2.9 GENERAL PLACARDS AND MARKINGS:

In conformity with BCAR Section T the following placards and markings are installed:

- All emergency controls are coloured red.
- All cockpit controls are clearly marked as to their function and method of operation.
- Fuel and oil filler openings are clearly marked, together with the grade or type required.
- Fuel tank capacity is clearly marked.
- Loading conditions are clearly marked as follows:
- Standard placards

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Loading conditions

Aircraft Payload Specification
Front seat pilot: 125Kg max, 60Kg min
Reduced pro rata to 110Kg max with up to 10Kg (max) of luggage in the nose locker.
Pilot must carry ballast to meet 60Kg min.
Rear seat passenger 120Kg max
Empty weight (as measured) Kg
Fuel load 0.72Kg/ltr
MTOW 500Kg

Aircraft must only be flown solo from the front seat.

Alternative engine rpm placard
(if constant speed controller fitted)

Engine RPM
Max Cont.: 5,500
MAXIMUM 5,800

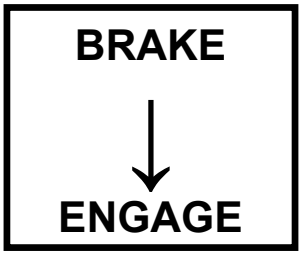
Max manifold pressure (take off): 39.9in Hg
Max continuous manifold pressure: 35.4in Hg

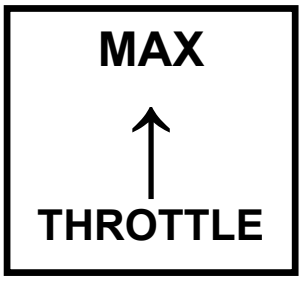
Position below constant speed controller
(if fitted, 914 UL engine only)

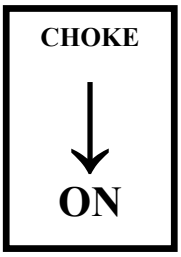
PROPELLER CB
RESET ONCE ONLY!

Beside circuit breaker, where fitted

Primary control marking







Limitations

OPERATING LIMITATIONS

Aerobatic Limitations
Intentional spinning is prohibited.
Aerobatic manoeuvres are prohibited.
Manoeuvres involving a deliberate reduction in normal 'g' shall be avoided.
CG Range Limits (Gyroplane) – refer to Pilots Handbook data.

Airspeed Limitations
Maximum Indicated Airspeed (Vne): 120mph

Other Limitations
This aircraft shall be flown by day and under Visual Flight Rules only.
Smoking in the aircraft is prohibited

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Occupant warning (front and rear seat)

OCCUPANT WARNING
This aircraft has not been certificated to an International Requirement

Fuel gauge (for those gauges with pushbutton)

Press before reading!

Auxiliary socket (where fitted)
May alternatively be engraved on the panel.

12v DC auxiliary socket

Roll trim indicator (where fitted)

Coolant header tank

Coolant Header Tank. Filled with 50/50 water/antifreeze

Engine oil tank

Oil tank Capacity 3 ltrs. Use Shell VSX or equivalent Motorcycle oil SF or SG

Fuel tank (both, where two fitted), either on the tank face or beside the filler neck.

Fuel capacity: 35 ltrs per tank Preferred fuel: MOGAS (AVGAS permissible)

At the base of the instrument panel.

Pilot rudder pedal position in this aircraft is Long/middle/short

Baggage placard for front locker (same for rear seat glove box and side pockets either side of the rear of the front seat where fitted, except loading is 2Kg and 1Kg respectively).

Baggage Load: 10Kg MAX

Low voltage placard mounted on instrument panel.

Continuously lit Low Voltage lamp indicates electrical demand exceeds supply, and the battery is being drained. If lit in flight, reduce demand until unlit. If flashing intensely, land asap.

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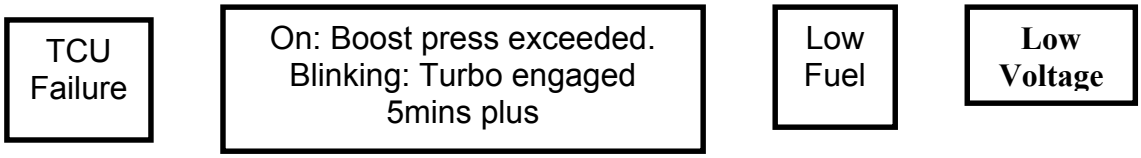
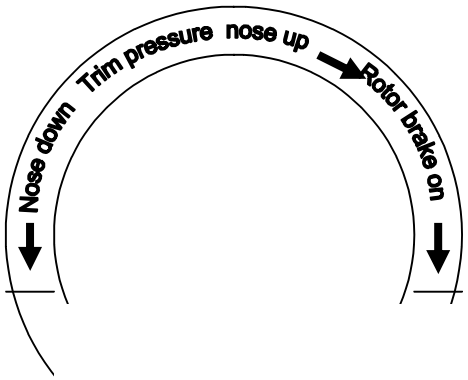
Warning lamp placards.



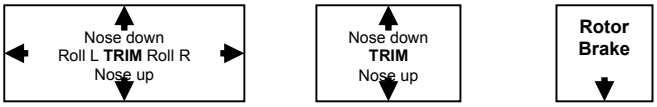
Pressure gauge placard



Front control stick (original)

Around the pre rotate button

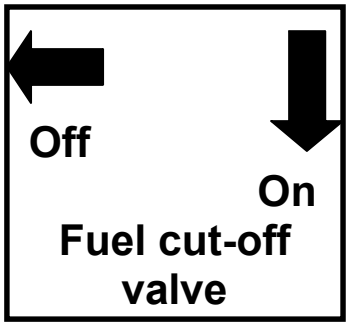
On top in front of the trim/brake button or and



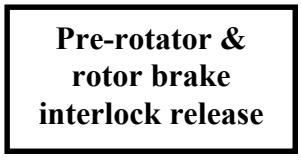
Front stick (G205 stick-grip or OEM stick-grip)
On top of control stick (either type) of stick grip)

(L Roll and R Roll only if roll-trim system fitted)

Fuel cut-off valve (where fitted)



Interlock placard (unless engraved on panel)



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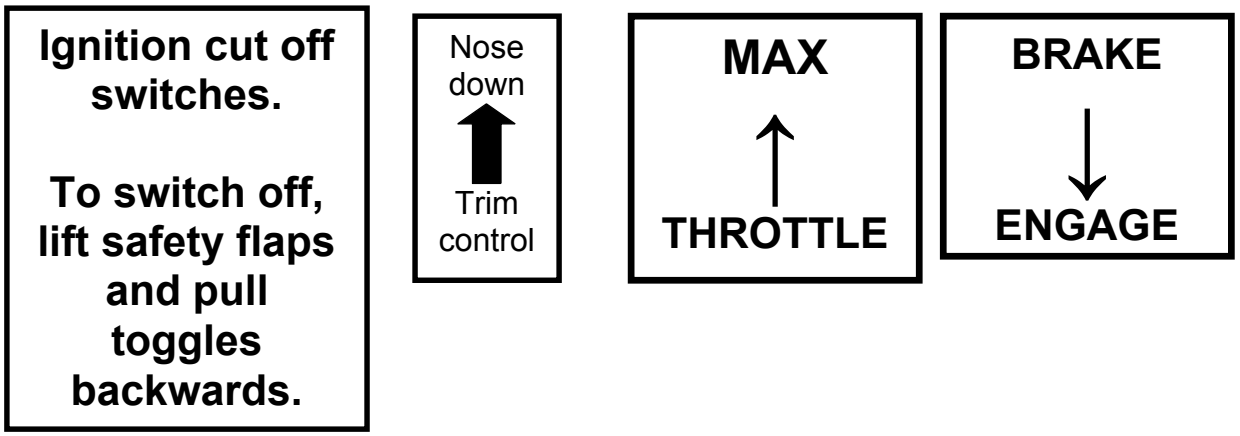
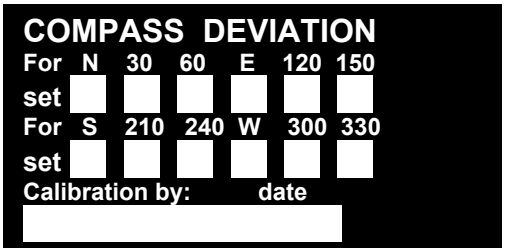
Instructor pack (where fitted). Brake placard only where brake is fitted.



- Other

  If the compass deviation is more than 5° on all headings, then a deviation placard must be present.

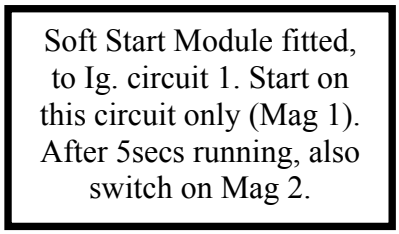


  Instrument placards as section 2.5

The aircraft is fitted with a permanently attached fireproof plate with the aircraft registration number and serial no. marked on it, on the keel or on front of the instrument panel.

The registration letters are placed high on the tail fin, and are 68cm long, 30cm high. This has been accepted to CAP523, the CAA standard for aircraft registration. Alternative markings and position of markings is acceptable provided they comply with this standard.

Options and upgrades
If SB-041 “Conair Sports SSM” is incorporated an additional placard is fitted adjacent to the Mag switches



Note that all placards must have the same units of measure as the instruments.

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3. EMERGENCY PROCEDURES

3.1 INTRODUCTION

The MTOsport gyroplane uses an engine which is not certified to normal aviation standards. Whilst normally reliable, engine reliability cannot be guaranteed, so always bear this in mind.

NOTE: Plan your flight route to allow for unplanned engine failures and subsequent forced landings. Regularly practice your forced landing procedures & techniques. During your type conversion ensure that you have experienced a full engine out landing, to experience the glide angle and distance required to land.

This manual is not a replacement for theoretical and practical training as to how to operate this machine. Failure to take proper instruction can have fatal consequences.

3.2 ENGINE FAILURE

In case of failure of the engine the following actions are recommended:

Taxying, before take-off – maintain directional control, brake and stop where safe.

Immediately after take-off - land immediately ahead.

In flight. **with some height (depends on wind speed and direction)** - consider the wind speed and direction. Select a suitable forced landing field, preferably up any slope, and if practical land into wind.

Landing in trees or high vegetation – take the vegetation surface as the runway, and position the landing to leave the minimum fall to the ground. Try to flare onto the surface to achieve minimum roll on speed. When the wheels contact the vegetation centre the control stick to reduce the risk of the rotor contacting the vegetation.

Rough running of the engine and power loss can be caused by carburettor icing. This is extremely unlikely on this aircraft as it is fitted with a hot water heated jacket around the carburettor inlets.
WARNING! Taking off into carb icing conditions without the engine warmed up properly may prevent the water jacket from stopping carburettor ice from forming.

3.3 ENGINE START IN THE FLIGHT

The engine should not be deliberately stopped in flight except as part of forced landing training under the supervision of a competent Instructor.
Where practical, to limit engine damage, leave the engine to idle at 3000 rpm for about 30 sec to cool before turning it off.

The engine can be restarted in flight using the starter. Use the procedure for starting described in Section 4.2, if possible allowing a 30 second period for warming up before applying full power. Note that to restart the key must be turned completely to off, and then back to start. This interlock is to prevent inadvertent starter engagement.

3.4 ABANDONING THE AIRCRAFT

In normal circumstances occupants should not leave the aircraft while either the propeller or the rotors are turning.

If abandoning the aircraft in an emergency the pilot should turn the off the engine magneto switches and turn the Master switch to "OFF" if this can be done without endangering the occupants.
If abandoning the aircraft with either the propeller and/or the rotors turning the occupants should follow a path in line with the nose of the aircraft, to minimise the risk of being struck by either the rotor or the propeller.

Occupants should be briefed before flight on emergency evacuation procedures, including:

- Actions to be taken in the event of a forced landing
- Operation of the seat harness
- Disconnection of any intercom leads or other connections to the aircraft
- How to safely exit and move away from the aircraft

3.5 SMOKE AND FIRE
Indications of smoke should be treated in the same way as a fire.

Fire on the ground: exit and abandon the autogyro, call the emergency services, use local fire fighting equipment if trained to do so

Fire in the air: Make an emergency landing, exit and abandon the autogyro. Call emergency services.

3.6 GLIDING FLIGHT & FORCED LANDINGS
The minimum rate of descent speed is 40mph (engine idle), giving a vertical descent rate of about 500ft/min at low aircraft loading, and 800ft/min at MTOW. Note that the rate of descent does not increase dramatically with speed increases up to 56mph. However, with the engine off, airflow over the rudder surface reduces as airspeed drops, to the point where there is limited directional control - so take care at very low airspeeds. The best glide speed is 60mph. The height:distance ratio with engine on tickover is approximately 1:5 (500 feet of forward movement for every 100 feet of height). With the engine stopped the ratio is approximately 1:4.
If there is sufficient height, take the time at best glide airspeed to make the choice of landing site, and then balance airspeed versus descent rate to make a safe landing in that area. When gliding into a headwind increasing airspeed will have a significant effect on groundspeed and noticeably improve the glide ratio.
In the final approach ensure airspeed is above 50mph, by lowering the nose, to give sufficient rotor energy for the deadstick flare, and airflow over the rudder for positive direction control.

Height loss with engine failure is, of course, greater than that with idle power. Ensure you understand the HV chart (5.3) to know what airspeed and height combinations are save to operate within.
If gliding for a long distance, either keep on a little power, or increase power periodically to keep the engine warm.

3.7 PRECAUTIONARY LANDINGS
Forced landings, and Precautionary landings (eg suspected mechanical problem or weather problem).
For a landing with a deflated tyre, proceed as follows:
Approach normally, with the intent of a 0mph run on landing directly into wind (& across the runway if needed). Flare the aircraft to achieve this, and use the rotor drag/brakes to limit forward speed. Only if impossible to recover the aircraft from the landing area should it be manoeuvred under it own power, as this could further damage the tire and wheel rim.

3.8 LOSS CONTROL

Loss of primary control systems could be

1. Engine power control. If jammed on, use ignition switches turned on/off to reduce power, and turn off when clear to land in a suitable place. If jammed off, land as per engine off.
2. Rudder control. Use power and rotor to drive into wind, and descend for landing into as large and as soft an area as possible, flaring for minimum ground roll.
3. Rotor head control. Normally the trim device will keep the aircraft flying in pitch. Roll control failure may lead to a flat descending turn. Use rudder, trim and power to balance aircraft, and descend for immediate landing into as large and as soft an area as possible.

3.9 ALTERNATIVE METHOD OF ENGINE SHUTDOWN

Turning the engine off with the mag switches simply earths the coils. If there is an electrical fault the engine can be stopped by isolating the fuel supply. Firstly, ensure the standby electrical pump is switched off. For the turbo engine, turning the keyswitch off will also turn off the primary fuel pump, starving the engine. For the 912ULS engine, which has an engine driven mechanical pump, turn the emergency cut off valve located on the enclosure edge, on the left hand side, just rear of the front seat. It will take about 30secs min for this method to stop the engine. Alternatively, in an emergency, fully close the choke, wait a few seconds, and open the throttle suddenly. This normally chokes the engine and causes it to stop, but is not guaranteed.

3.10 WHAT TO DO IN THE EVENT OF PITCH OSCILLATION OR ROTOR RPM REDUCTION DUE TO NEGATIVE G.

Never try to control pitch oscillation with the stick.

Smoothly closing the throttle whilst maintaining a level flight attitude will return the aircraft to a stable, slow speed condition very quickly, from which the pilot can recover to normal flight.

This recovery technique is safe in all such situations where there is sufficient altitude to give the pilot time to work out what to do.

4. NORMAL OPERATIONAL PROCEDURES

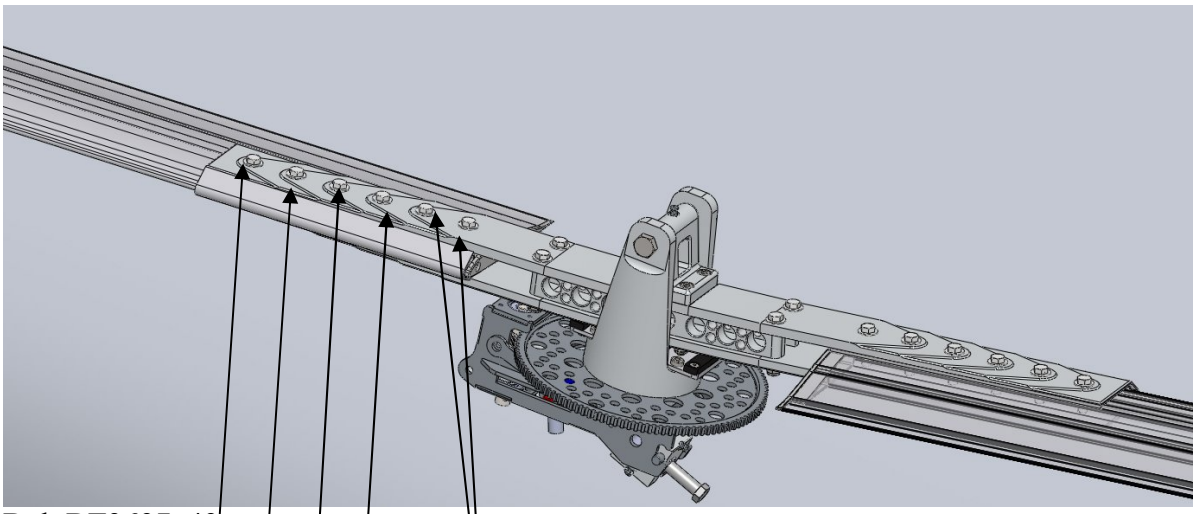
4.1 INTRODUCTION

Section 4. contains check lists and procedures to be used for the normal operation. Procedures for additional equipment are in Section 8.

4.2 ROTOR RIGGING

The aircraft may be fitted with either 8.4m (black end caps) or 8m (grey end caps) rotors. They are directly interchangeable, assembled in exactly the same manner, and no adjustments are required to the rotor controls. If SB-040 has been incorporated the aircraft will be fitted with RotorSystemII (red end cap) rotors. These rotors are **not** interchangeable with the earlier rotors.

Assembly rotor:
The rotor blades, spacer extrusion and hub are provided with numbers to define the installation direction. By matching these numbers, put the blades into the hub. Fit the 9 bolts fitted with 'thin' 9mm washers through the hub and blade assembly from the top, and fit an 8mm 'thin' washer and M8 nyloc on the lower surface. The bolts are a close fit – and may need a light tap to push home. Raise or lower the blade with respect to the hub to achieve this. DO NOT hammer them in! For early blade sets (identified by square edges to the hub bar), hand tighten only, and adjust the tracking. Do this with a taut string between the cutouts in the blade ends. Tap the blades in the hub bar such that the string passes directly over the centre of the grease nipple in the centre block. When satisfactory, tighten all 18 nuts to 25Nm. For later blade sets no tracking adjustment is normally required. Simply tighten all nuts to 25Nm.
With the black or grey end-cap rotors the bolts are all the same length. With RotorSystemII (red end caps) there are only 6 bolts, of 5 different bolt lengths as these vary to suit the scalloped hub-bars. Ensure that they are fitted in the correct position, as shown below.



WARNING! It is important to fit the correct length bolt in the associated hole! Fitting the wrong length bolt may result in insufficient safety protrusion through the nylock nut, or that the nut jams on the shank of the bolt before the joint is properly tightened.

Other notable differences: the RotorSystem II hub bar is scalloped, with different lengths of blade to hub bar bolt, and is also heavier than the earlier rotor. Typical weight is 30.5Kg. The built-in coning angle is also increased from 2deg per side to 2.85deg.

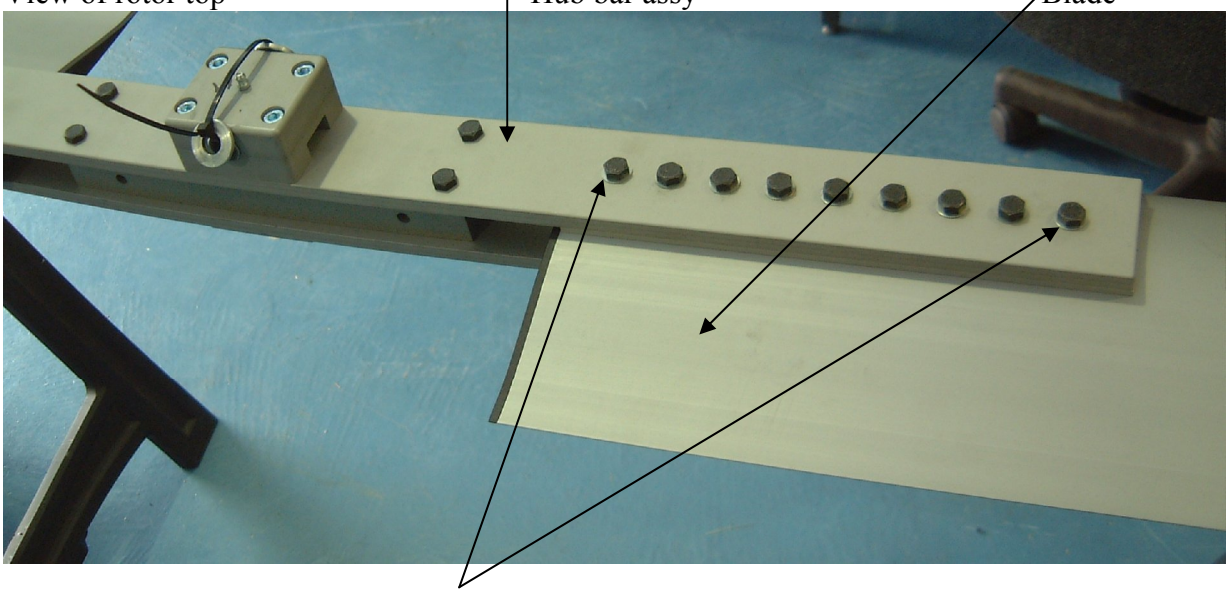
It is very important that the correct rotor is used with the correct type of rotor head tower and teeter stops. The RotorSystemII rotor will not fit to an earlier rotorhead. An earlier rotor (black end caps or grey) would fit the RotorSystemII rotorhead, but the teeter stops would allow excessive movement, potentially causing rotor to make tail or propeller contact. The tower used with a RotorSystem II rotor is 40mm higher than that used on earlier aircraft.

When assembling, or diss-assembling, do not remove or adjust any other nuts/bolts on the hub assembly – the tracking is factory set, and adjusting may change these settings and adversely affect rotor balance.

To fit the rotor to the aircraft proceed as follows:
1. Brake the aircraft securely.
2. Engage the rotor brake with the rotor hub set fore/aft.
3. With the aid of a helper, and some steps (or use the rear seat if tall enough), raise the rotor assembly up into the rotor head.
4. Push through the teeter bolt (making sure the two spacers are greased and in place either side of the hub block) and hand tighten. These spacers may be two different thicknesses. Fit as dot marked on the rotor and head hub.
5. Tighten the nut to the required torque (hand tight, 1-2Nm, never tight), and fit a split pin through the nut, and secure the pin appropriately.
6. Sideways free play is pre set by the bushes provided the nut is not overtightened.
7. Grease the bolt via the grease nipple where fitted.
8. Ensure the rotor teeters to the stops freely.

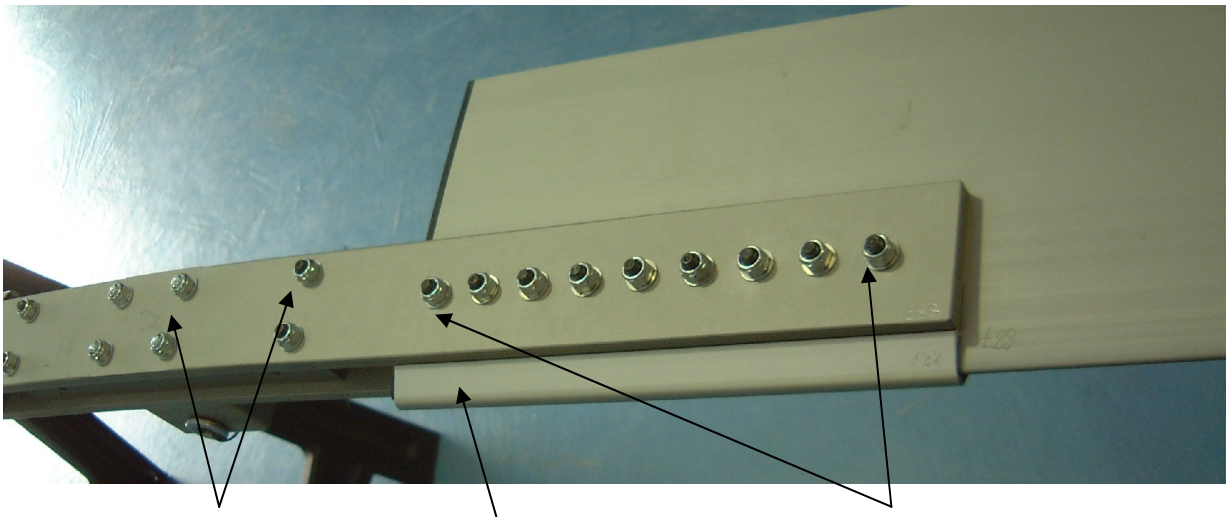
Views of 9-bolt rotor system (black or grey end-caps)

View of rotor top



9 x Rotor blade attachment bolts with 9mm bore washer under head
These bolts are all the same length

View of rotor bottom



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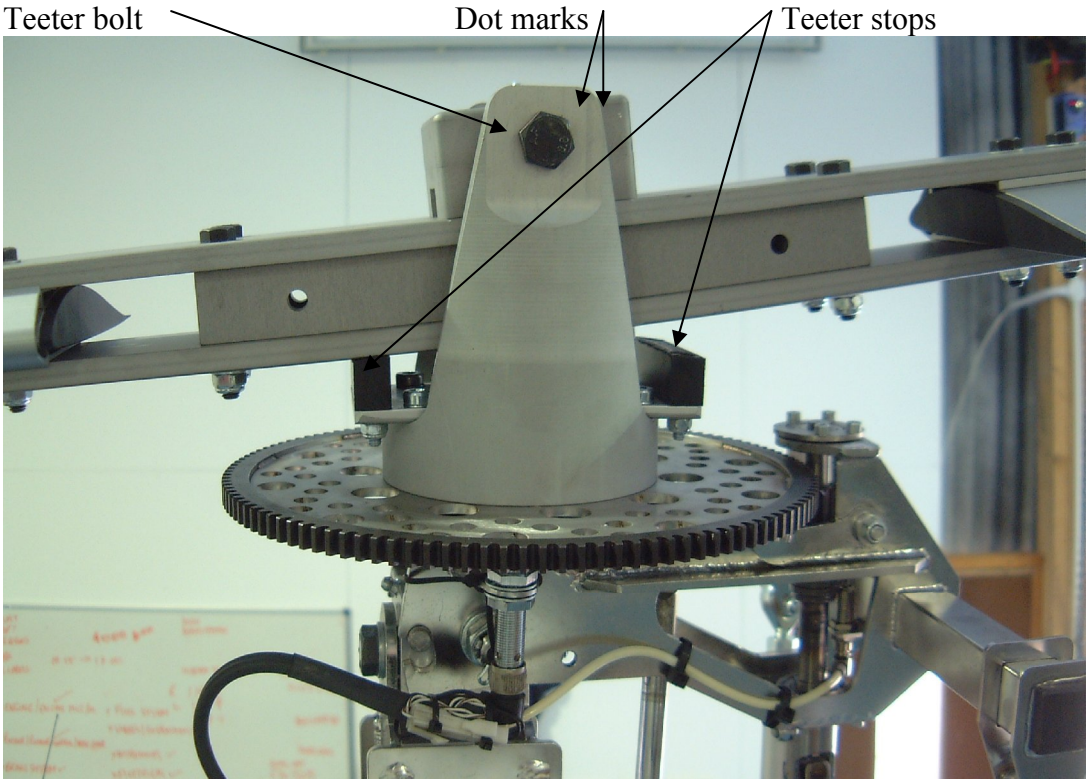
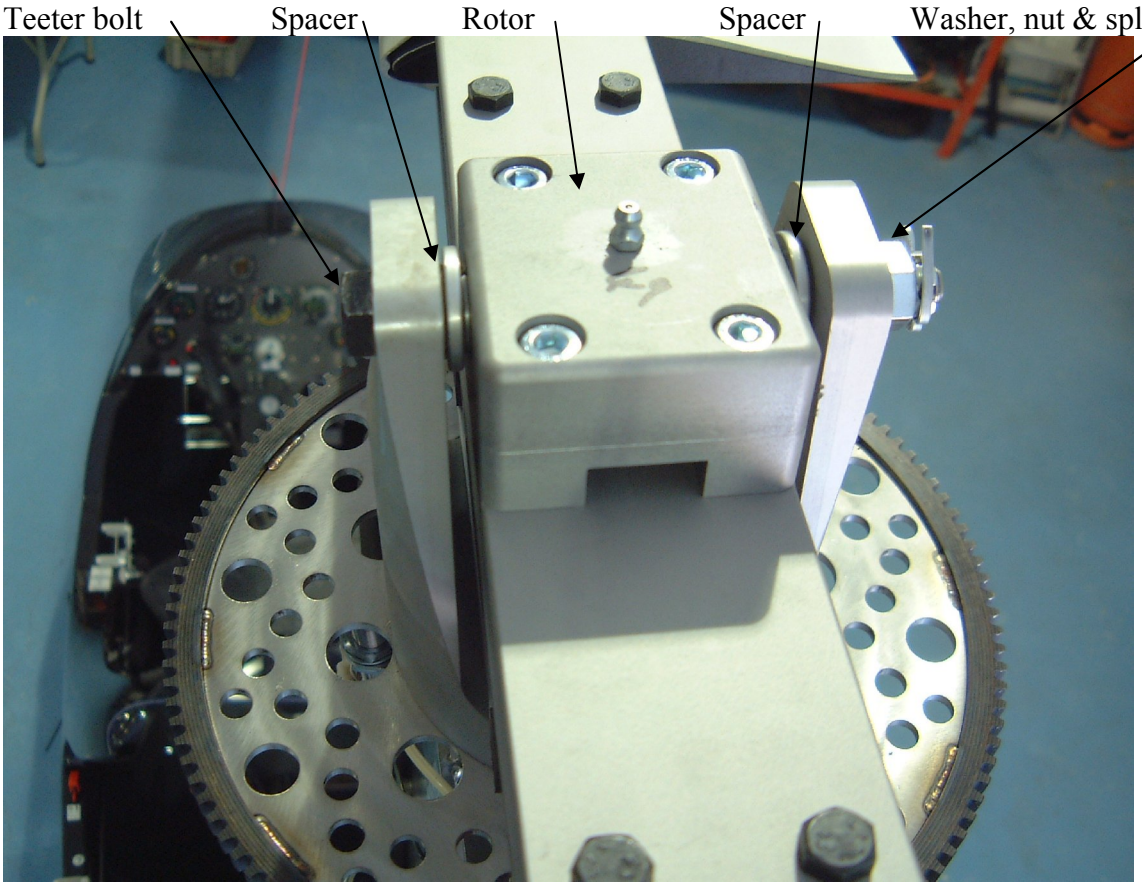
View of black or grey end-cap rotor installed

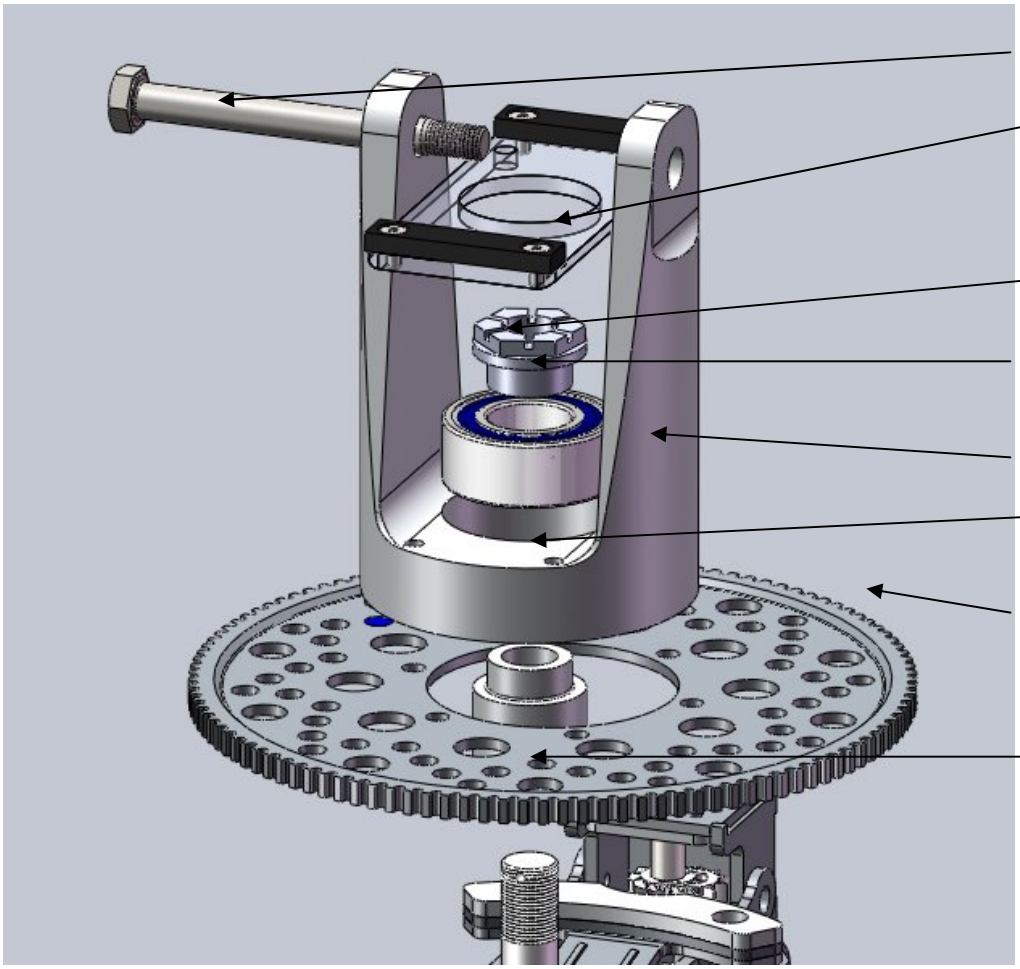


Top view of rotor installed

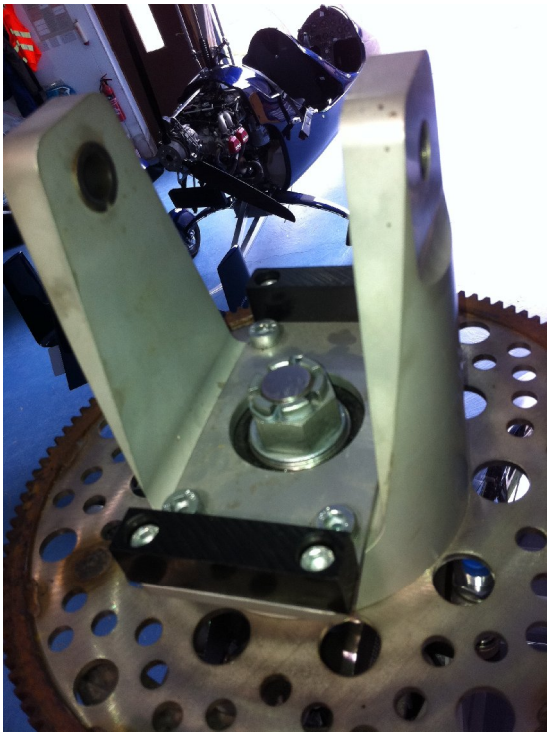


Match parts using dot marks on tower, spacer and hub (normally one dot or two dots)

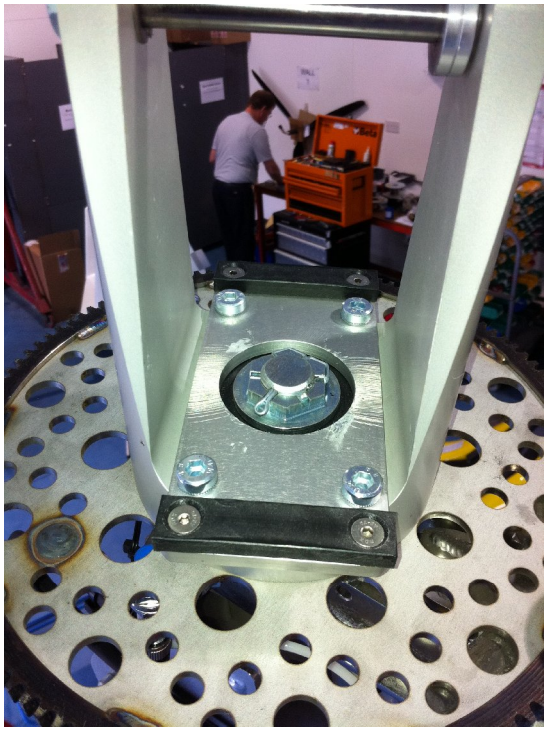
Additional views below show the differences between the original and RotorSystem II construction.


Teeter bolt (carry over)
Teeter stop plate assy (new)
Main bearing nut (castellated, new)
Bearing (no change)
Teeter tower (new)
Bearing spacer (new)
Pre rotator drive gear (carry over)
Bearing bolt (M20, new)

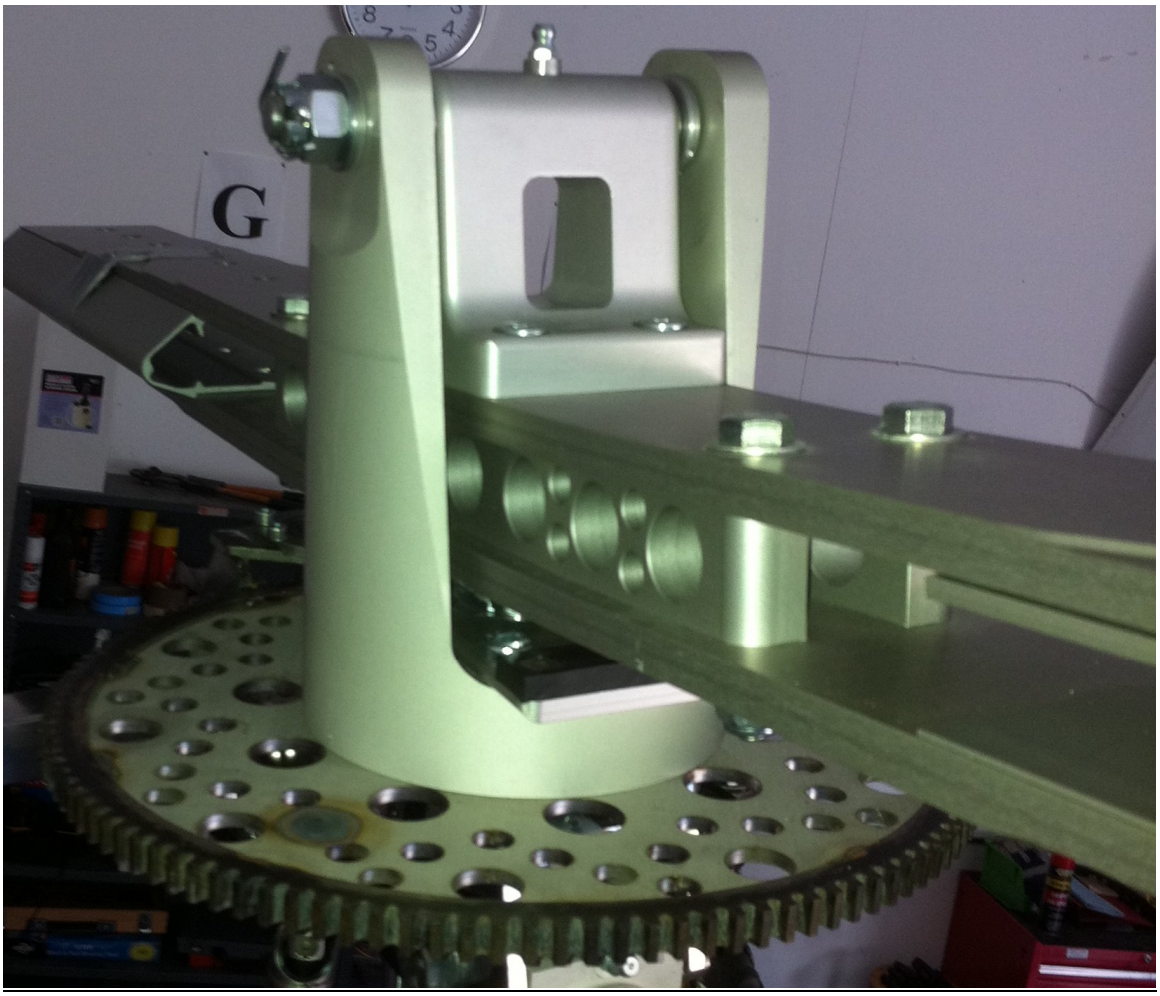
Section view of rotor head with RotorSystem II parts shown.



Old rotor head assy



Rotorsystem II head assy



View of RotorSystem II fitted (rotor blades not installed).

4.3 DAILY & PREFLIGHT INSPECTION

Most, if not all, technical problems can be found with a conscientious and careful pre-flight inspection. In your own interest, take the necessary care and attention with your aircraft. The safety and integrity of an autogyro stands and falls with its regular, conscientious examination and maintenance. Use the full pre-flight checklist shown below.

MTO series GYROPLANE PRE FLIGHT CHECKLIST

This list is a guideline of items to be checked prior to the flight. No checklist is "All Inclusive", nor is it to be construed as a substitute for proper training or pilot experience.

Task	Aircraft area	Task & task type
A1	General	Note; wherever possible checks should be carried out with a qualified person in the pilot seat in case of accidental starting, and to operate controls correctly. Op/C - Both ignition (magneto) switches in sound condition and switched OFF Remove frost, snow or ice, if present Check - that the gyroplane documents are available and in order. Ensure all loose equipment is correctly stowed and the gyroplane is free of extraneous items. If single seat operation, ensure rear belt fastened securely, and if rear seat cushions are attached by Velcro only, stow them securely. Check – weight & balance, and carry suitable secure ballast if required If the gyroplane has not been regularly used, ensure before resumption of flying that: (a) Either (i) the engine has been turned weekly or run fortnightly or (ii) the manufacturer's recommendations have been complied with (b) Previously reported defects have been addressed
A2	Windscreens	Inspect - for damage and cleanliness (clean as required)
A3	Composite enclosure	Remove pitot head cover if fitted, and inspect orifice for cleanliness Inspect - radio aerials for damage and security Inspect - condition and security of fiberglass enclosure
A4	Landing Gear	Inspect - that extension appears normal Inspect - tyres for proper inflation (1,5 to 2,2bar), damage and creep Inspect - brake installation for external evidence of leaks and correct fluid level, and for damage and security Inspect – brake disc securing screws (4 each) are secure Inspect – that nose wheel pivots easily, both springs are correctly attached (if an MT-03), and control rods are fastened correctly Inspect – suspension bow for cracks and security of fastenings
A5	Flying Controls	Op/C - Rudder controls move rudder and nosewheel from lock to lock and operates in the correct sense. Inspect - Rudder pedals for security of hardware, for proper operation, and for absence of binding. Inspect - Rudder cables for security of hardware and nico clamps, cables for fouling, fraying and kinking, and for cable tension. Op/C – Both control sticks moves freely to roll and pitch stops simultaneously with the rotor head and in the correct sense. Inspect both stick fastening bolts/nuts for security. Inspect – Pneumatic control set to 'BRAKE' not 'FLIGHT'. Inspect – linkages between stick and rotor head for loose bearings, loose items, bent or damaged tubes or excess backlash (undo rear seat top fastening & fold forward for access). Op/C – vertical pre rotator slider moves freely without any jamming.
A6	Powerplant/ Engine	Service/lube - Oil reservoir level correct & cap secure, & coolant system full with correct fluid. Inspect – coolant (water and oil) hoses free from splits Inspect - All springs secure and wired where appropriate, esp exhaust Inspect - Exhaust system securely mounted, and free from splits or cracks, leaks etc. Inspect - Air filters clean and secure Inspect - Engine mountings in place and secure and rubbers free of cracks or any deterioration Inspect - Plugs and plug caps secure Op/C - engine controls for full and free movement in the correct sense Inspect – coolant and oil radiator for condition, security and leakage, **Note:** inspect all soldered joints for evidence of cracking. Inspect – all 'loose' cables around engine for correct attachment and connection Inspect – security of SSM module (if fitted)

Task	Aircraft area	Task & task type
A7	Propeller	Inspect - Propeller blades & hub clean and free of cracks, splits & damage Inspect – Prop tape secure and undamaged (if fitted) Inspect - Propeller blades securely mounted to hub, and hub to engine (all bolts/nuts present and secure. On HTC propeller, check torque stripes to ensure that bolts have not turned, and on Woodcomp prop check nut tab washers are bent over). Op/C - Propeller and engine turns over smoothly (in normal direction of travel only) with no undue noises etc (with ignition OFF and throttles closed!!) *Remember, it may start!! If possible chock the aircraft and/or apply brakes!* Op/C – if a variable pitch propeller, operate the control to cycle the propeller to both pitch limit stops. Then set propeller controller in 'Take Off' mode or fine pitch if under manual control
A8	Fuel System	Inspect - Both tanks (where fitted) for security and condition, ensure absence of leakage, check cap for seal and security, check fuel shut off valve (where fitted) for proper operation and positioned 'ON'. Inspect – for fuel leakages (pressurize fuel system by turning keyswitch and electrical fuel pump ON for the test, and then back off again). Op/C - Check fuel gauge reading same as actual tank level, & qty sufficient. Inspect – fuel for water content via drain points under each tank. Inspect - check fuel line for security, cuts, dry rot, and kinks**.** Inspect - Fuel filter – ensure filter is clear of debris
A9	Rotor	Inspect - Rotor teeter bolt, nut and locking pin in place and rotates freely Inspect - Blade to hub bolts, washers and nuts in place Inspect - No sign of blade cracking or other failure (visual check) Op/C - Rotor teeters freely to stops (both planes) and rotates freely (check with/without control stick). Inspect - Blades clean and free from chips, dents or damage Inspect – that teeter bolt has been correctly lubricated Check – bolts (6) connecting prerotator gear to rotor hub are secure
A10	Spin up mechanism	Op/C - Secure and free, and that the belt is free of splits/cracks (note; if the belt is dry vibration during pre rotation may be experienced: lube with dry lube PTFE or equivalent silicon spray) Inspect – pre rotator bracket & system for cracks or damage Inspect - pre rotator universal joints for free operation or failure Inspect – engine mounting bracket for cracks/fractures Op/C – pre rotator brake works with panel switch switched to 'BRAKE' Inspect - lower shaft rubber boot for damage and free movement of slider shaft.
A11	Tail assembly	Op/C - condition and security, check surface for delamination, check cables for fraying and secure connection to rudder, check nico clamp for security, check horizontal stabiliser and fins for security and any sign of damage from heavy tail down landings. Op/C – check rudder bearings for security and operation Op/C – check that cable pulleys work smoothly with no cable fraying Inspect – Trim tab is set correctly
A12	Cabin area & Instruments	Op/C - Safety harness mountings secure, webbing free of tears/frays, and connects/disconnects freely on demand Inspect that seats are securely attached to airframe (and rear seat refixed in place) Inspect - Radio secure, battery charged (if applicable) Inspect - Electrical wiring sound and secure - no sign of overheating or damage Inspect - instrument readings are consistent with ambient conditions Inspect - Test operation of electrical circuits Inspect - that markings and placards are legible Inspect – Roll trim, where fitted, is set fully left (no trim)
A13	Airframe	Inspect – Welded joints for any sign of distress or accident damage (all areas, but especially the mast to lower airframe behind the seat and under the engine). Inspect – all hardware for tightness/security
A14	Pneumatics	Inspect airlines and cylinders for loose fittings

A15	Other	Op/C – brake lever operates normally and brakes function. Op/C - Ground run. Check both electric fuel pumps (where fitted) are operational before starting engine. Confirm full power obtainable (if practical), & that engine, propeller & rotor vibration is within normal limits. Confirm all gauges reading normally. Check - Remove any rotor retaining straps, and close any luggage bags/lockers.

4.4 FLIGHT OPERATION

The manual is not replacement for theoretical as well as practical training as operates this machine. Failure to take appropriate instruction can have fatal consequences. Before commencing flight operations, and before each flight, the pilot must complete a visual check of the autogyro. Expertise necessary to do this it is obtained during the pilot training.

4.5 NORMAL PROCEDURES AND CHECK LIST

ENGINE START PREPARATION

The engine must only be started if the pilot's seat is occupied by a person trained in the aircraft operation.

Fig 2. gives the basic control layout. Control elements, functions and operation are as follows:

Item function	Status	Operation
Main switch (9) key	OFF	Turn anticlockwise
	ON	Position centre
	START	Turn fully clockwise (spring return to centre)
Throttle (4)	CLOSED (IDLE)	Pull to the rear
	FULL POWER	Push forward
Choke (5)	ON	Pull back to the rear
	OFF	Push forward & down
Ignition switch (23)	IGNITION ON	Both switches up
	IGNITION OFF	Both switches down
Brake (6)	ENGAGED	Operate by pulling the hand lever back to the throttle lever. Lock if needed with pawl.
	OFF	Squeeze lever to throttle and unlock pawl – open hand.
Fuel cock (912ULS only, where fitted)	ON	Lever in line with aircraft centre line
	OFF	At 90 degrees to a/c centre line
Fuel level (12)	Fuel level must visible in the tank, to the level required for the flight	Also view fuel gauge for same reading as on tank

TO START ENGINE (WITH STANDARD IGNITION SYSTEM)

Main switch	ON (generator warning light on)
Choke	Engage (until engine warm and will run without choke.)
Throttle	Closed
Propeller	Danger area – keep clear! Fine pitch, if variable pitch propeller.
Brake operation	Lock brakes on
Magneto switches	On (both)
Starter	Operate until engine starts. Take care! Do not run the starter continuously for more than 10secs, and no more than 30 secs in 2 mins – damage to the battery or starter may result.

TO START ENGINE (IF SB-041 Conair Sports SSM INCORPORATED)

Main switch	ON (generator warning light on)
Choke	Engage (until engine warm and will run without choke.)
Throttle	Closed
Propeller	Danger area – keep clear! Fine pitch, if variable pitch propeller.
Brake operation	Lock brakes on
Magneto switches	Mag1 ON, Mag2 OFF for initial start using ignition circuit 1 only. When the engine has started ignition circuit 2 should be introduced (after about 5 secs) by selecting Mag2 ON. When the engine has been warmed to normal operating temperature the pre-flight "Mag-drop" checks must be performed in the normal way
Starter	Operate until engine starts. Take care! Do not run the starter continuously for more than 10secs, and no more than 30 secs in 2 mins – damage to the battery or starter may result.

Check list before the start

1. Safety belts on and secure
2. Helmets secure
3. Parking brake on
4. Fuel supply on
5. Altimeters adjusted
6. Rudder control effective
7. Wind direction known
8. Variable pitch propeller controller, if fitted, set to 'Climb mode or fine pitch if under manual control.
   Warning! Starting the engine with coarse pitch may result in engine or propeller damage!
   NOTE! See section 8.3 for operation of the Woodcomp VP propeller and controller.
   Note! The pitch change warning lamp lights when the prop pitch is actually changing, and goes out when the pitch stops are met.

Commence start

After turning the master switch on, the 'Gen' (alternator charging) light will come on, and the boost and TCU electronic check lamps will light for about 2 secs (if Turbo engine). Before starting the Turbo engine, listen for fuel pump noise, and then switch on second pump, and listen for noise increase. If either pump does not run, STOP and investigate. Second pump may be left on, or turned on when ready for flight.

The second pump should be used as a backup for take off and landing only. It is not required for normal flight use, unless low on fuel.

The low voltage warning light may also come on, especially if already using heated clothing. It flickers gently when the alternator voltage is similar to demand voltage, and goes off when demand is exceeded. Check that it goes off when the engine is run up. Flashing intensely (about 2 to three times per second) & very bright means the alternator supply voltage has exceeded the set levels, and is overcharging. In this case stop and resolve.
Once started the 'Gen' light will go off, indicating the alternator is working. In low light conditions it may be seen to flicker gently. This is normal.

Check oil pressure. If not increasing correctly shutdown engine immediately and find the cause. When the engine is warm, close the choke. For starting a cold engine, have the choke fully out and throttle closed, otherwise the choke does not work. With a warm engine do not use the choke. Warm the engine up at approx 2000rpm, then at 2,500rpm until the oil temperature reaches 50°C.

Check for mag drop at 4,000 rpm by turning off each ignition switch in turn. There should be a 300rpm max drop off, and max 115rpm difference between coils.

GROUND HANDLING:
The behaviour of the nose gear wheel is easily learned with some taxiing practice. The nose wheel is not like the MT-03 (self centering), instead having direct links to the nosewheel. When turning at low speeds brakes and power may be used to turn as well as the pedals in order to reduce the turning circle.
It is possible that high speed taxiing, or certain loading and ground conditions may cause nose wheel shimmy. In this event, either slow down, or if wheel balancing, slow down or raise the nose.
When moving on the ground take care where the rotor disc is relative to the wind direction, and unless loading up the disc, keep the stick into the direction of the wind to avoid being tipped over.
The aircraft has a high centre of gravity, and is most at risk during ground handling when lightly loaded. Whilst taxying at up to 30mph is safe in a straight line, corners must be taken slowly to prevent the aircraft tipping over.
Be careful not to keep the brakes engaged for a long taxy with the choke on – the choke idle rpm is higher, and the resultant thrust increases the brake loads, and can lead to brake fade on a long taxy. Intermittently apply the brake instead.
WARNING! Excessive idle rpm on long distances will cause brake pad fade and possible pad damage. Idle rpm should be approx 1600.

START AND CLIMB
If possible always take off into wind, and ensure CHT and oil temp at least 50degC.
The maximum cross-wind component for take off is 22kts.
Set the roll trim, if fitted, to fully left.
Switch the pneumatics switch to 'TRIM', which releases the rotor brake.
Keep the engine at about 2000rpm, and the control stick forward.
Disengage the parking brake lock pawl, and hold brakes on by squeezing throttle and brake lever together.
Actuate the pre rotator by pressing the button, and as rotor speed increases, increase engine speed to suit. Normal pre spin is a rotor speed of 200 rpm (maximum Prerotator speed is 270 rpm). If the rotor speed overtakes the pre rotator, and the pre rotator disengages, release button. Increase engine rpm and re engage.
Disengage pre rotator and pull the stick fully back. Check/adjust trim pressure to about 2bar or less if lightly loaded to reduce stick load on take off
Let go brakes, and bring the engine up to take off power.

Hold direction using the rudder, and as soon as the nose gear wheel takes off, keep the nose down to build up airspeed and take off in a flat attitude.
If necessary reduce stick force by actuating the trim.
The best climb speed is 60 to 65mph. Set variable pitch controller to 'Climb' if fitted (if not already set so).
After reaching your chosen altitude (eg 500ft or circuit height), throttle back to level flight rpm, as required for your chosen airspeed.
Pay attention in hot weather to the cylinder head and oil temperatures. If these should rise with long climbs over the placarded values, then adjust your speed or attitude to compensate.

Note that it is possible to operate without the pre rotator. In this situation, start the blades by hand to about 45rpm. Taxy slowly into wind, and, holding the stick back, let the rotor speed increase. It will take about 320m to reach over 200rpm, at which stage full power can be applied and normal take off procedures continued with.
WARNING! Take care! Holding the stick fully back brings the blades close to the rudder, and blade flap/ system flexibility, or bumpy surfaces could cause contact! About midway should be adequate, learn with practice!

CRUISE
Turn off the back up electric fuel pump
Transit from climb to cruise, and use the trim to reduce stick force in the chosen cruising speed. Trim position can be seen from the pneumatic pressure gauge.
The speed range for the cruise lies between 50 and 90mph with engine speeds from 4000 to 5500 rpm. If fitted, set the VP propeller controller to 'Cruise' – or manually adjust .
The most economical speed is about 75mph.
The permissible maximum speed (V_{NE}) is 120mph and must not be exceeded.
WARNING! In strong gusty conditions do not fly faster than 70mph. 50-60mph is a safe manoeuvre speed for such conditions.
The cruise fuel consumption is approx. 12 ltr/hr at speeds around 75mph to approx. 20 ltr/hr plus at 120mph, depending on aircraft loading.

LANDING
Before making the approach check all key equipment and functions.
Turn ON the back up fuel pump.
If fitted, trim roll for left position.
Set VP propeller controller to 'Climb' if fitted, in case of a go-around.
Ensure brakes are not locked on, and electric fuel pump turned on.
The landing should take place into wind. Maximum crosswind limitation is 15kts.
Reduce engine rpm and speed to 70mph on short final.
Final approach speed should not be under 55mph. If in turbulence or rain, 60mph. As the aircraft closes to the ground, reduce the speed by flaring and touch down with the main wheels. Hold the stick back to use the rotor as a brake, and reduce speed for taxy. Reduce engine power as required for taxy or idle if at rest.
When required, turn pneumatics selector switches to ROTOR BRAKE, and engage rotor brake (& push the stick forwards). Take care in windy conditions to prevent blade flap, and move stick into wind if needed! Blades can be parked fore and aft the aircraft by either increasing brake pressure at the appropriate time by pulling the stick rearwards, or by depressing the brake interlock release button, and momentarily engaging the prerotator. A little practice may be required.

After engine has idled for at least 30 secs, turn the engine off using the ignition switches, and then turn main switch off. Do not exit the gyroplane until the rotor stops turning.

An emergency landing is made exactly the same way, except that the above speeds should be maintained in order to ensure sufficient rotor energy is left for the final flare.

WARNING! FUEL MANAGEMENT!
The primary pump fuel pickup is located at the front of the left fuel tank, with the backup pump at the rear. In normal level flight with two persons on board the fuel tanks are angled towards the rear by around 2 deg. In descent the tanks in the same configuration could be up to 8 deg nose down. This is the time when fuel level is likely to be lowest, and an engine stoppage least wanted. – therefore the pickups are configured to be located to maximise the available fuel. However, this means that at a steep nose up attitude on low fuel the forward pickup could be uncovered.
Therefore, when low on fuel (less than 10ltrs remaining) turn on the backup fuel pump! Otherwise the engine may stop from fuel starvation!

Zero fuel contents is marked at 3.4ltrs per tank.

ALWAYS plan your fuel loading to suit your flight, with headwinds and alternate airfields in mind.
ALWAYS make a safe precautionary landing to get more fuel, rather than wait for an unsafe emergency landing because you have run out of fuel!

Check list after flight finish

1. Ensure master switch and electrics are off (prevents a flat battery)
2. Clean and check aircraft ready for next flight (better to find failures now than when you are eager to fly!).
3. Park in the proper area, chock wheels, and cover. Unless required for safety, it is best to leave the aircraft unbraked when parked.
4. Complete logbooks.
5. Celebrate an excellent flight!

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5. PERFORMANCE

5.1 PERFORMANCE DATA

The following operational parameters were confirmed as a result of flight testing. Note that this assumes the engine and aircraft are in good condition, with an averagely capable pilot. The parameters apply to standard conditions (sea level, normal pressure, 15°C, zero wind, max take-off weight 500Kg or as noted, even field with short grass in good condition). Airfield altitude, higher temperature and low air pressure will change performance data.

SPEEDS
Minimum speed (Vmin) 30mph (914T or lightly loaded 912ULS) 35mph for 912ULS MTOW
Manoeuvre speed (VA) 50mph
Cruising speed up to 115mph
Permissible maximum speed (VNE) 120mph

CROSS-WIND
The maximum demonstrated cross-wind component for takeoff is 22kts.
Landing should always be made into wind where practical. The maximum landing crosswind 15kts.

TAKE OFF DISTANCE (MTOW)
Take-off run 20 - 170 m (66-560ft) (depending upon loading and wind force)
Take-off distance over 15m (50ft) obstacle 320m (1056ft) in still wind with the rotors at 200rpm on grass, hot conditions.

LANDING DISTANCE
Landing run 0 - 20 m (66ft) braked (although brakes are not normally required)
Landing distance over 15m (50ft) obstacle 80m (260ft)

MINIMUM CLIMB RATE (with standard propeller)
Light single-seat 1,200fpm (912S) or over 1,500fpm (914T)
Two seat (500kg) 500fpm at MTOW (912S) or 700fpm (914T)

ROTOR RPM
Assumes steady state (cruise) conditions

MTOW (500kg)	395rpm (8m) 367 (8.4m)
Average TOW (383Kg)	345rpm (8m) 322 (8.4m)
Min TOW (310Kg)	310rpm (8m) 290 (8.4m)

Rotor rpm will naturally rise from this for a short time in gusts and turns, and will fall if G loadings are reduced. If a reduction in rotor speed is noted, ensure your flight attitude is one which loads the rotor, and take immediate action, if needed, to achieve this. If rotor speed fluctuations are observed when in a flight state that they should not, then land and investigate immediately.
RPM will also increase as speed increases, and with altitude.

Rotor rpm will also fall by about 10 to 15 in a minimum speed ‘hover’ due to the engine thrust supporting the aircraft. Be careful, particularly when lightly laden with maximum power that you do not lose further rpm and rest on the engine power alone. Rotor RPM should not drop below 280rpm in flight.
There is also a meter recording the rotor bearing temperature. Land and investigate if there is any significant rise over the ambient temperature!

5.2 FURTHER DATA RANGES

The range depends on the fuel consumption, which is proportionally larger with high airspeed, as with lower. The most favourable consumption lies somewhat above the speed of the best climb. With two full tanks approximately 340miles is available with a cruising speed of 65mph in still air, but this should be established by trial for each individual aircraft/loading condition

NOISE DATA

The MTOsport meets the German BUT noise protection requirements for ultralight autogyro of 68dB(A) max.

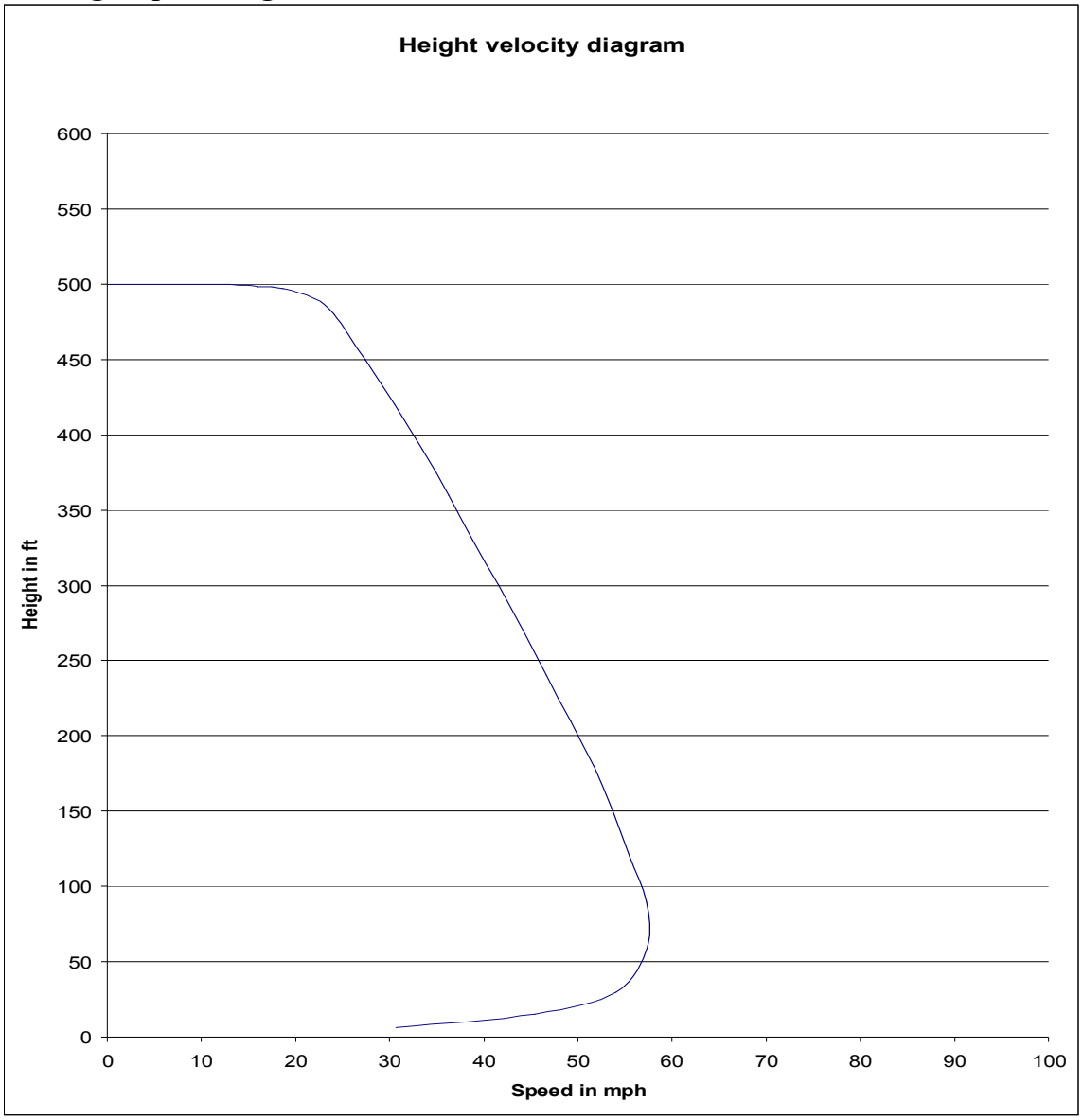
TYRE PRESSURE

Main landing gear wheels 1.5 to 2.2 bar
Nose gear wheel 1.5 to 1.8 bar

SERVICE CEILING

The service ceiling is 10,000 ft.

5.3 Height speed diagram



The height speed diagram indicates the minimum height for the flown speed (IAS), at which a safe landing is considered possible at max all up weight, 8m rotors following engine failure.
Engine failures whilst flying at heights and speeds to the left of the graph line may prove fatal for the pilot and passenger.

6. DESCRIPTION

6.1 GENERAL STRUCTURE

The framework of the autogyro consists of an inert gas-welded high-grade stainless steel tubing framework. The tail unit structure is manufactured in GRP (or in certain cases Carbon fibre RP). The engine is attached via a steel tube carrier (motor mounting frame) at the rear of the mast. The rotor system is manufactured from aluminium extruded sections. The main landing gear sprung spar is made from GRP, and the nosegear mounting fork is stainless steel tubing. The fuel tank is manufactured from polyurethane. Fuel pipe is fire resistant fabric-strengthened rubber hose. The windshield consists of break-proof Makrolon. The pilot enclosure and wheel spats consist of GRP or CRP composite material.

6.2 Controls

Rotor

The rotor head control is via a normal push/pull rod system, mounted on the keel giving both roll and pitch, with a traditional stick in the front cockpit. Pushing the stick forwards tilts the rotor head forwards, and pulling it back tilts the rotor rearwards. Left or right tilts the rotor disc in those directions.

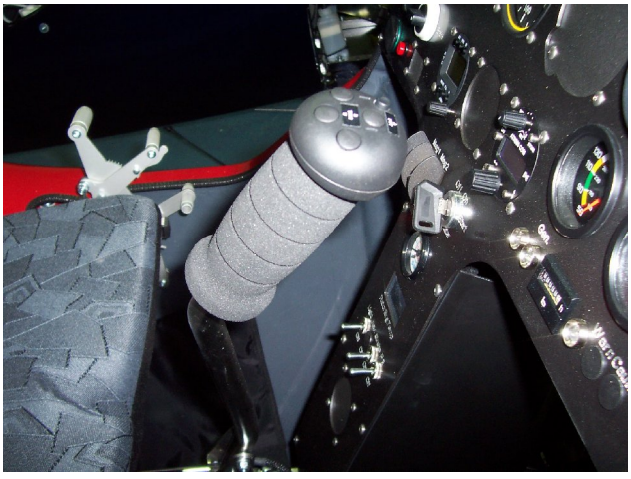
Stick grips and functions - Three grip types are available

Pre rotator engage button

Trim (forward nose down, rear nose up) and sideways for roll where fitted.

Press to talk (PTT)

Unused, no function



The trim pushbuttons on this grip are arranged logically Fwd/Back & L/R. The pre-rotator button is top-left and the PTT on the front face

MC-162 introduces an alternative stick-grip, optimised for use with gloved hands (OEM stick grip). To ensure that operating clearances to instrument panel and seats are maintained the alternative installation is supplied as a pre-wired stick-grip assembly. Its placarding is the same in content but positioned differently. (MTOsport installation is shown below).

Placards fitment if pitch-trim only

Placard fitment if pitch & roll trim fitted

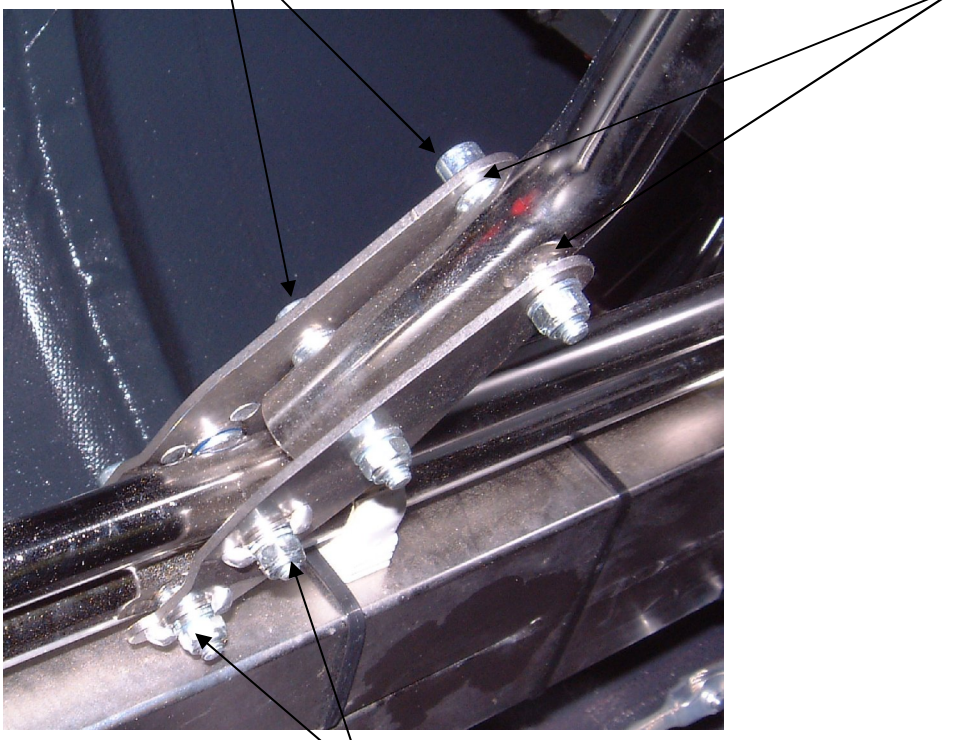
Rear stick

A rear seat stick is available for training purposes. It has a simple grip without push-buttons.
There are two rear seat stick options. The standard stick is the same length as the front stick, and is general purpose. Stick changes must be noted in the aircraft logbook.

The 'Instructor' stick is a special long length, giving instructors extra leverage over the student in the front seat. IT IS DANGEROUS to fly with this stick with a normal pilot or student in the rear seat, as that person may be able to overpower the pilot control. When fitted, it is important to ensure full travel of the Instructor stick before flight. The long length means that it moves closer to the instructors abdomen, and bulky clothing etc will get in the way.
The 'Instructor' stick is clearly marked with a red band and appropriate etching.

The stick may be removed for weight saving or safety by taking out the two bolts holding the stick in. On no account must the bolts holding the side plates to the horizontal control rods be removed.
NOTE! The aircraft logbook must be annotated when the stick has been removed or refitted. A duplicate inspection is recommended!

Remove these two M6 cap head bolts. Note there is a washer between the stick and the side plate, both sides of the stick, both bolts.



Do not remove these bolts

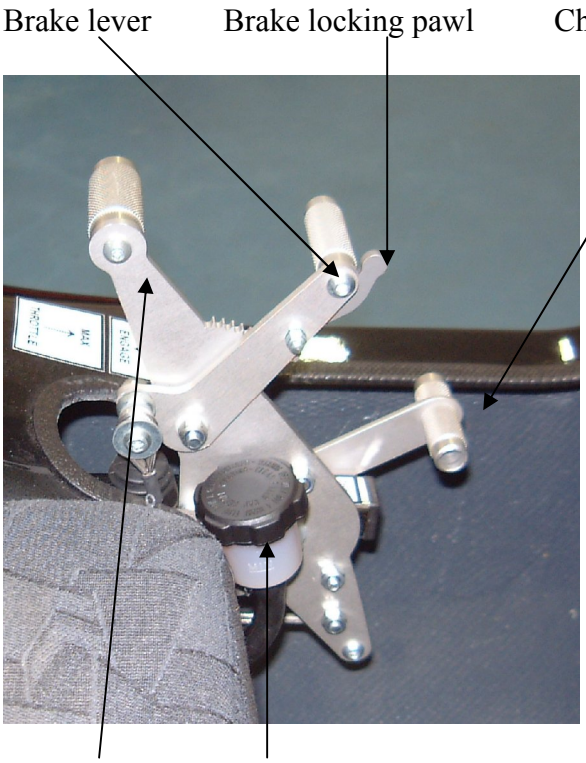
Note: It is also possible to minimise the rear-stick mountings and rear rudder pedals, so that there is less risk of interference with these controls by a rear-seat passenger or baggage. Such modifications require implementation of MC-135 (stick) and/or MC-131 (pedals) – contact RSUK for further information.

Rudder

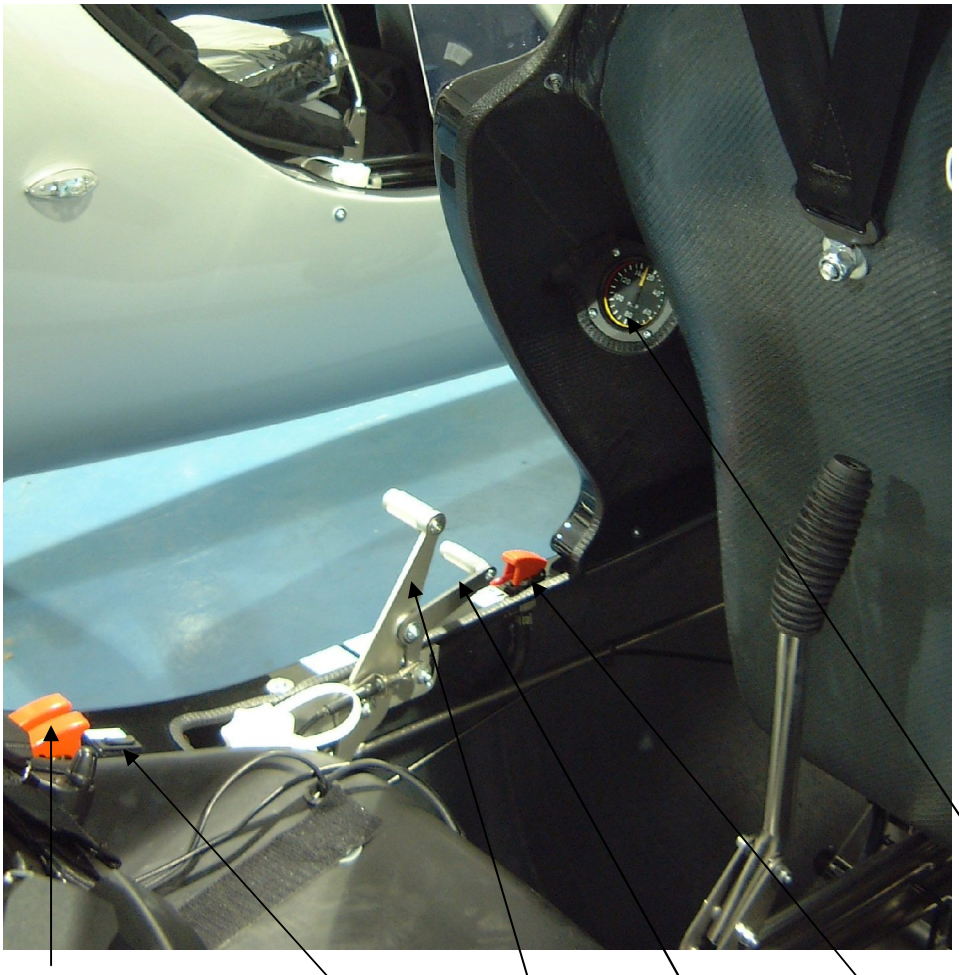
The rear rudder pedals are connected to the rudder via steel cable, and to the front pedals by linkages via the nosewheel for steering. Pushing the right pedal will turn the aircraft right in the air and right when on the ground.

Throttle

The front seat is fitted with a throttle, choke and brake lever cluster (see photo). The brakes may be locked on using the detent locking pawl. Pushing the throttle forward increase power. The choke lever is pulled rearwards to engage, and if inadvertently left on, is pushed off when the throttle lever is moved forwards.



The rear seat is not fitted with a throttle as standard – this is an instructor option fit. The unit is retained with two screws from the top, and one screw and nut retaining the link to the front throttle. The unit may be removed. The unit may also be fitted with a brake lever to operate the mainwheel brakes via a Bowden cable to the front seat throttle cluster. Again, this may be removed, with the appropriate tools and replacement parts.
The rear seat area may also be fitted with a trim switch, mag kill switches and an ASI, as instructor pack 2. These are not intended to be removed once fitted.



Rear seat kill switches Trim switch Throttle Brake Fuel cut off Rear seat ASI

A PTT button is mounted to the left of the seat, and a 12v aux socket fitted if required.

6.3 INSTRUMENT PANEL

The arrangement of the control elements and instrumentation in the cockpit is represented in fig. 2. Differences may occur depending on the equipment fitted.
There may be unused switch or indicator positions on the panel, these may be fitted with blanking plugs

1. Change over switch pneumatics (TRIM to ROTOR BRAKE)
2. Altimeter
3. Airspeed indicator
4. Engine rpm (or CS controller)
5. Oil pressure
6. Cylinder Head temperature
7. Oil temperature
8. Ignition switch (one for each coil)
9. Charging (Gen) lamp
10. Main switch
11. Rotor rpm
12. Compass
13. Hour meter
14. Roll trim indicator where fitted
15. Rotor bearing temperature
16. Air pressure gauge for Trim and Rotor Brake
17. Accessory switches
18. Electric fuel pump switch
19. Radio (if fitted)
20. Fuel gauge
21. Rotax engine status lights
22. Pre-rotator & rotor brake interlock release
23. 12v Auxiliary socket
24. Transponder if fitted

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25. Low fuel light 26 Low voltage lamp
27,28 (where fitted) Propeller pitch change lamp and pop out fuse

Fig 2, instrument panel

REMARK: Note the pushbutton on the fuel gauge shown above. If such a button is fitted in or adjacent to the gauge it must be pressed before reading the fuel level. If there is no button the gauge is an electric type which shows the level at all times the instrument is powered.

CSC-1 controller

Pop or pull out circuit breaker

LED warning lamp (lights when pitch is changing)

View of left side of panel if fitted with Woodcomp SR3000/3 propeller and CSC-1 controller

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6.4 Wheels/tyres

Both the mainwheels and nose wheel use tyre size 400/100-2Ply (with inner tube). If flying in the winter with a frozen-over or snow covered runway, it is advisable to remove the wheel spats in order to avoid their damage and snow build up inside them. It is the pilot's responsibility to ensure that in the rear part of the spat no snow has built up, which could lead to freezing against the wheels and stopping them from turning. Always use loctite 243 on wheel spat screws, or any other screws removed that do not have a locking method.

The above tyre is used for its light weight (1.085Kg) and low replacement cost. Approved heavy duty alternative is 4.00-8 55M tyre, which weigh 2.04Kg each. Other tyre options require specific approval. Knobbled tyres are not recommended due to their ability to pick up stones and flick them into the propeller arc.

Arrangement nose gear wheel and main landing gear
The main landing gear consists of a GRP bow, which is fastened to the airframe. The lower end carries the wheels, which are braked with hydraulic brakes. The nose gear wheel sits in a fork pivoting in the airframe from high-grade steel tube. It is non retractable, and has stops in both directions. The main landing gear and nose gear wheel are maintenance-free. The nose gear wheel pivot is to be greased as required – it must be always free to rotate, with slight friction load only. Check the fixing bolts of the brake disks before each flight. Change tyres when worn (to change the tyre the nose wheel must be removed from the chassis) as per maintenance manual.

6.5 Seats and belts
The seats are GRP bowls, which are fastened to the frame structure by screws, and transfer the pilot weight on the airframe structure. For single-seat flights only the front seat is used, so the cushions of the rear seat have to be removed or secured! A four point harness is fitted in both seats, so the rear belts must be fully fastened prior to single seat operation to prevent excess flapping or loss/damage in flight.

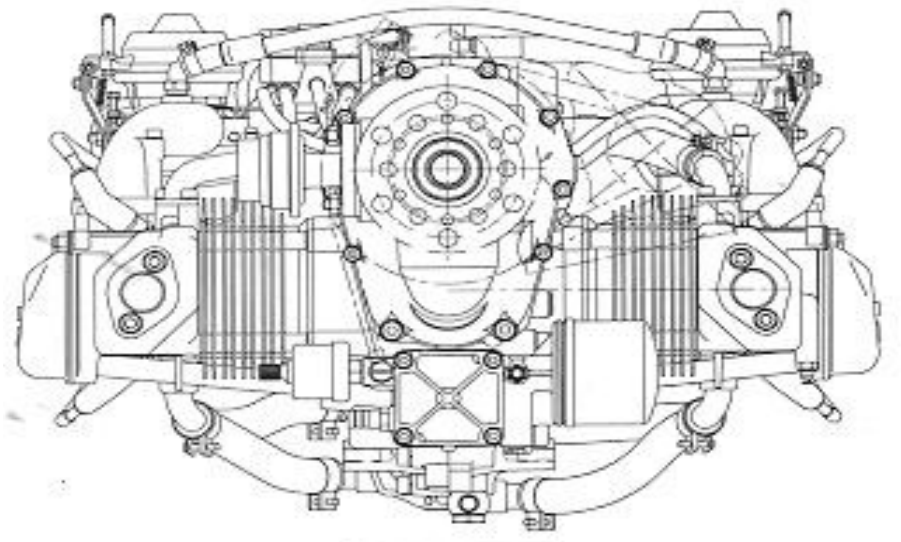
6.6 ENGINE
The engine provided is either a 4 stroke Rotax 912 or 914. This engine is appropriate for the market, and is in use on many other similar aircraft – but possesses no certification. Engine failures occur with more regularity on uncertified engines, so always plan your route and fly in such a way that an emergency landing is safely possible. To ensure maximum reliability, complete all maintenance requirements in line with manufacturers recommendations on time and regularly check the Rotax websites for information on any engineering changes or service recommendations.

When replenishing cooling agents never use pure water, only the recommended 50/50 mixture of ethylene glycol antifreeze and distilled water (or Evans NPG+ or equivalent only if marked on the filler).

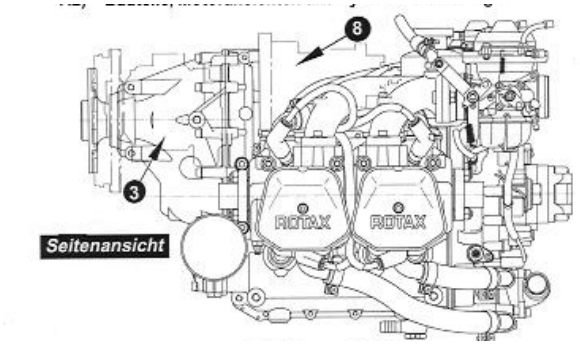
Air cleaners to be replaced or cleaned according to the manufacturers recommendation.

Fig. 10 engine
(1) Engine serial number
(2) Carburettor
(3) Propeller gearbox
(4) Electric starter

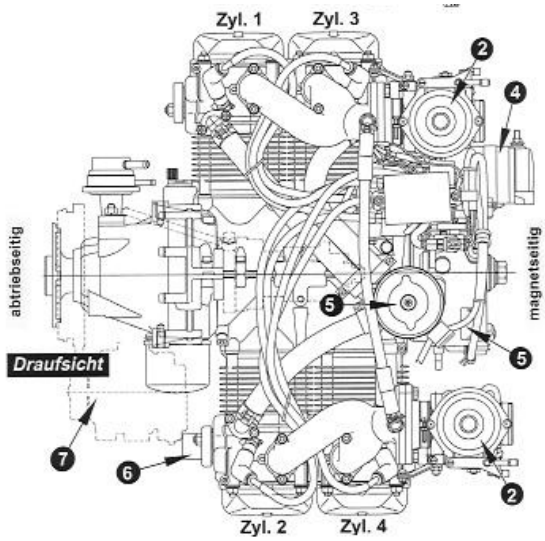
(5) Coolant filler cap with overpressure
(6) Exhaust manifold



Rear end view



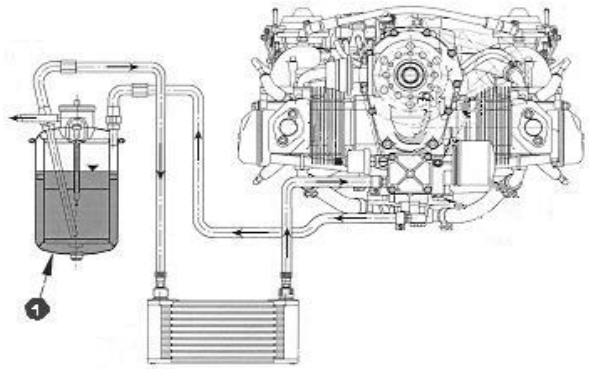
Side view



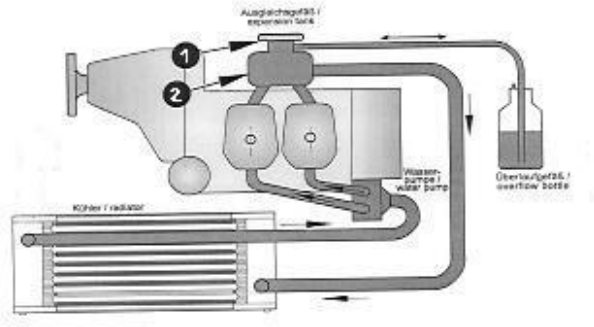
Top view

DESCRIPTION: 4-cylinder.-4 stroke double-piston engine with dry sump lubrication, hydraulic tappets, electronic double ignition, electric starter and transmission. For detail function, technical data etc. see engine manual.
REMARK: 912ULS engines after S/no. 6.775.360 have redesigned ignition modules which give improved starting but different slow-running characteristics (See RSUK SIL-003)
REMARK: The aircraft may be retrofitted with SB-041 “Conair Sports SSM”. This is a different soft-start system to that described in SIL-003. In this system the engine is started on ignition circuit 1 only (Mag1 ON only) and ignition circuit 2 introduced (by additional selection of Mag2 ON) when the engine is running.

Always ensure oil level is correct before flight (oil reservoir is item 1)! The oil level is measured in aircraft level attitude and should reach between the marks on the dipstick. Before checking, turn the engine by the propeller approx.. 8 - 10 revolutions in normal direction of rotation, until you clearly hear the oil gurgle in the tank (take the tank filler cap off first to hear it better). Switch ignition off first!
To get to the tank, remove the top thumbscrew holding the rear seat to the airframe and hinge the seat forwards.



As a check of the coolant level the filler cap (1) of the expansion/storage vessel (2) can be opened, but only with a cold engine.

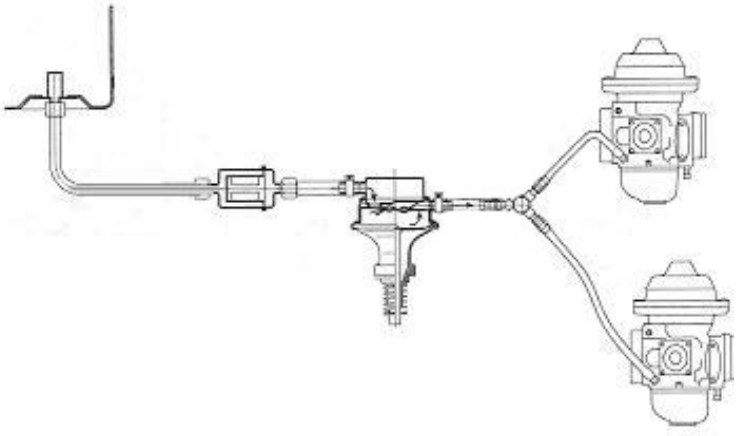


REMARK
Since the exhaust and its attachment are exposed to high loads by temperature and thermal expansion, these should be frequently checked.

6.7 FUEL SYSTEM
The fuel system is under the rear seat and has a capacity of 35 ltr per tank. The tank is ventilated by a ventilation line above the tank to the rear of the mast. Tank level control is via sight lines on the side of the tanks, a fuel gauge on the instrument panel, and a low fuel warning light.

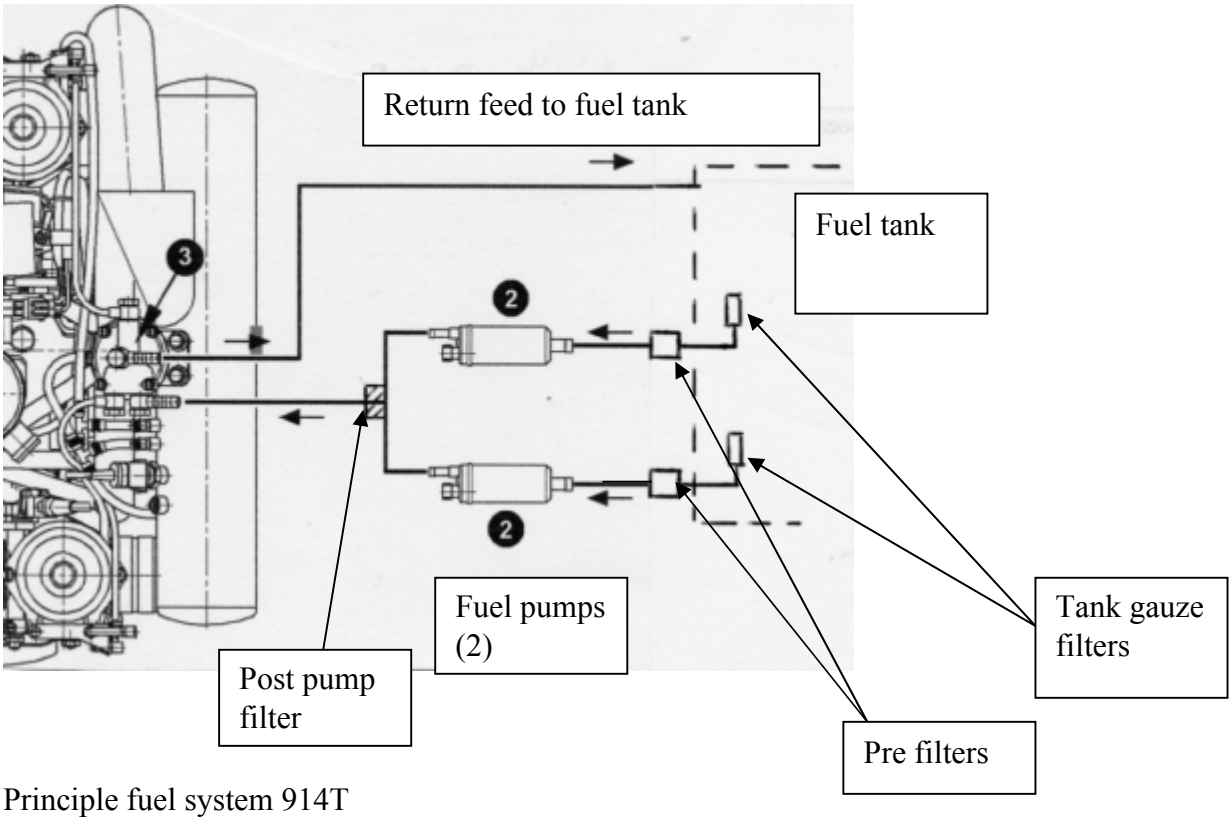
Note: the left fuel tank can be drained almost empty in any flight attitude, but the crossover from right to left only works with the tanks level or nose up. Prolonged descent at very low fuel levels may result in the engine stopping from fuel starvation!
Zero fuel contents is marked at 3.4ltrs per tank

Principle sketch fuel system 912S



The engine mechanical pump is backed up with an electrical fuel pump.

WARNING
Fill tank up to max. 2cm under the filler hole, to allow for thermal expansion of the fuel.



Principle fuel system 914T

6.8 ELECTRICAL SYSTEM

The diagram attached in the Maintenance handbook shows the electrical system of the autogyro.
With the Ignition switch OFF the engine is isolated. However, be aware that unless the master switch is off other electrical items will work, and may draw current.
The starter should be used for short periods, 10secs maximum, as the nominal running current draw from the starter motor may be up to 75amps. Overuse may result in internal battery damage and early failure.

Use of optional items such as heated clothing all draw a significant amount of current. The amount will depend on individual circumstances.

Engine current availability and usage - MTOsport gyroplane

Item	Amperage	Wattage
Engine and engine systems, inc elect fuel pumps (912ULS)	5A	60W
Engine and engine systems, inc elect fuel pumps (914UL)	8A	96W
Filser ATR 500 or ATR833 radio (when transmitting) (Max 0.5A, or 6W, on standby)	2.5A	30W
Filser TRT800 Transponder	0.7A	10W
Garmin GPSmap max, normally about 4W	1A	12W
Landing lights, 2x50W	8.3A	100W
Heated gloves (PER PAIR)	1.5A	18W
Heated jacket (PER JACKET)	6.4A	77W
Airworld (or Aveoflash) strobe lights Maximum value	1A	12W
Woodcomp SR3000/3 propeller (when changing pitch)	2,5 to 3A	36W max

Notes: normally only the mechanical or one electrical fuel pump is used in flight, saving 3 amps

Actual current available from the alternator/rectifier	**22A**	**250W**

Warning!
Overloading the electrical system will drain the battery (rated at 8Ahr). On a 914UL aircraft, both fuel pumps are electrical, so draining the electrical system may stop the engine!

A 'Low Voltage' warning light is fitted to show when the alternator is unable to supply the electrical demand, such that the battery is being drained. If this light comes on, reduce electrical load until it goes out – eg turn off landing lights or heated clothing. When the supply is nearly equal to demand the lamp will gently flicker. If the regulator has failed such that voltage supplied exceeds the normal regulator supply and is overcharging the battery, then the light will flash very brightly, two to three times per second.

6.9 PITOT AND STATIC PRESSURE
The measuring probe for dynamic pressure is in the nose of the enclosure. The hose connecting this to the ASI leads directly to the instruments in the cockpit. The static pressure is measured in an area forward of the instrument panel.

6.10 AVIONICS
Radio.
Option fit is the Filser (Funk Werk) ATR500 radio for both external and internal comms. The wiring harness terminates in a Binder connection at each seat, and the antenna may be mounted in the tail as built in, in the nose, or underneath the enclosure (for carbon fibre bodies). Ensure the helmets chosen function correctly before flight.
Note that the ATR833 radio was released under MC-199 as option fit for the MTseries.
For radio setup and usage instructions, refer to Funkwerk handbook (ATR500 manual Document-No. 01.1251.010.71e or ATR833 manual Document-No. 01.1402.010.71e).

The ATR500 radio JAA approval number is LBA.0.10.911/113JTSO
The ATR833 radio complies with ETS-2C37e, ED-23B Class4,6 and ETSO-2C38e, ED-23B Class C,E to standards TSO-C37d, RTCA DO-186A Class 4,6 and TSO-C38d, RTCA DO-186A Class C, E.

Transponder.
Option fit is a Filser (Funk Werk) TRT800 or TRT800H Mode S transponder. The antenna protrudes just in front of the nosewheel. Read the user manual for operational instructions, and take care that the Mode S hexadecimal code and aircraft recognition data is correct!
Where fitted the transponder is a Filser TRT 800 ED73, with EASA Approval no. EASA.210.045 or Filser TRT 800H with EASA Approval no. EASA.210.269

Remark; A Radio Operators licence is required to allow use of the radio, and a Radio Installation licence is required for the radio and transponder (one combined licence, renewed annually).

GPS
Garmin GPSmap 196, 296 and 496 (and variants) are optionally fitted to the panel. Other GPS units as per individual modification approvals.
These units are protected from the aircraft, and vice versa, by the inline fuse in the unit power supply lead (normally the plug that fits into the aircraft aux power socket). Never operate with the fuse bypassed, otherwise a malfunction in the unit may lead to equipment fire.

Always read and understand the handbook before operation, and never rely only on the GPS. The software maps or data may be out of date, or it may simply fail. The safe way is to plan to use a chart and compass as primary navigation tools, and GPS as a backup.

Some GPS units and antennas emit magnetic fields that vary with respect to time and/or levels of battery charge. These may change your compass deviations, so always cross check between the compass headings with your GPS installed and placard accordingly if required.

The installation of further devices is possible, but the operator must be aware that this increases the unloaded weight and current draw on the engine.

Note that the avionics are an approved package – modification or other installations require CAA/RSUK approval.

6.11 NAVIGATION LIGHTS

These lights, where fitted, may not conform to the relevant ANO. They are not intended for use as approved night flight equipment.

6.12 OPTIONS AND MODIFICATIONS

See the aircraft certificate of conformity for modifications fitted at point of release to service.

For confirmation of all modifications permissible in the UK, contact RotorSport UK Ltd Ltd or check the RotorSport website aircraft owners page where they are listed. Alternatively the aircraft TADS issued by the CAA lists all approved modifications for the type, and is available from the CAA website.

7. HANDLING, MAINTENANCE AND SERVICING

7.1 INTRODUCTION

This chapter contains manufacturers recommendations for correct ground storage of the autogyro, and also recommendations for maintenance and servicing required for
performance and reliability. Reference should also be made to the aircraft Maintenance Manual.

The regular care and cleanliness of engine, propeller, rotor system and enclosure is the first point for aircraft reliability. Do this on a regular basis, more often if weather demands. Insect debris build up on the rotors and propeller reduce performance and increase vibration. In order to avoid bird droppings or soiling of the MTOsport, one should cover the aircraft with the aircraft cover (available from RSUK), a light plastic tarpaulin or a cloth.

Openings to the engine, service points and airspeed indicator should be closed after the flight (beware of insects, birds etc.). Contamination of the autogyro can be removed with clean water, with low strength cleaning additives. Do not use petrols or solvent for cleaning the glazing, as this will DESTROY it!!
The parking area of the aircraft should be protected from the sun, wind and humidity. If it stands continuously outside, then it is exposed to strong UV aging, corrosion by humidity, sun and wind, and the manufacturers will take no responsibility for the safety margins eroded by such actions.

Dark-coloured aircraft are particularly susceptible to heat build-up from direct sunlight that can cause surface imperfections or distortion to appear in the composite parts. Dark-coloured composites should be protected from prolonged exposure to sunlight-induced high temperatures whenever possible. All aircraft can be damaged by storage in exceptionally humid conditions, as moisture will cause excessive corrosion and can penetrate into the composite materials causing blisters to appear under the paint finish. Whenever possible storage should be in dark,dry conditions.

7.2 REGULAR MAINTENANCE REQUIREMENTS

It is the owner and pilots responsibility to ensure the aircraft is properly maintained in accordance with the Maintenance Manual, document no. RSUK0044. Failure to do so may invalidate your Permit to Fly. Maintenance and inspection tasks must be performed by CAA (or LAA if an LAA permit) authorised persons or organisations. Repair processes such as welding or composite layup, or others not documented in the maintenance manual, require prior repair process approval from RSUK/CAA.

An annual aircraft inspection and flight test is currently required.

Engine

The engine should be maintained in line with the manufacturers engine manual, and reference must also be made to their service bulletins, available via their website http://www.rotax-owner.com/.

Propeller

The MTOsport propeller is approved with either a 3-Blade-HTC with a diameter of 1,73 m, or a 1.7m Woodcomp SR3000/3 in flight adjustable propeller.

Pilot maintenance is limited with HTC propellers to cleaning and visual inspection. An overhaul is normally only required if significant blade damage is evident, which will require return to RSUK. Minor chips may be filled with resin – see aircraft Maintenance Manual.

The same applies to the Woodcomp SR3000/3 variable pitch. However, the polyurethane leading edge should prevent all normal stone damage and rain erosion.
Note that because the SR3000/3 propeller is in flight adjustable, it has to carry it's own logbook. It must also be maintained in accordance with the propeller maintenance manual RSUK0076.

Battery
The engine possesses a generator, which charges the battery (rated at 8Ahr) during the flight. The aircraft is fitted with a discharge-safe gel Elekrolyt battery, which is maintenance-free. Maintenance is therefore limited to outside soundness, correct attachment, and cleaning. Monitor also that no contents of the battery has leaked out. This contains corrosive sulphuric acid, which can lead to heavy damage on contact with the airframe and attachments.

7.3 REPAIRS
Repairs may be implemented by the owner, but are limited to the exchange of defective parts in line with relevant CAA publications. Unless documented in the Maintenance manual, only original spare parts may be used, supplied with an Approved Certificate. Parts are available from RotorSport UK Ltd. See the maintenance manual for detail information

7.4 GROUND HANDLING & ROAD TRANSPORT
Aircraft are generally exposed to larger loads on the ground than in air, especially in road transport. Since the structure is designed for air use, this can induce a safety risk. Hard landings and rough ground (especially potholes) all induce high accelerations on the autogyro framework, as does being bounced around on the back of a road trailer. Therefore avoid unnecessary road transport, and use trailers with good suspension. Always protect the aircraft from road salt etc with appropriate packaging. If road transport cannot be avoided, transport with minimum fuel, which reduces airframe load.

7.5 CLEANING AND CARE
Contamination of the rotor system and propeller can be removed with clean water, with low strength cleaning additives. Clean rotors will significantly reduce vibration and increase lift.
Be careful when cleaning the windscreen – no solvent or petrols, as these will lead to cracking. Use only soapy water, and dry carefully to avoid scratching. RSUK also recommends Plexus, excellent for cleaning screens without scratching. Use clean stockinet to polish.
A good quality polish helps protect the surface finish and reduce surface friction.

7.6 WINTER OPERATION
The cooling system for the cylinder heads of the engine is filled with a mixture of antifreeze and water, which gives freezing protection to -18°C. The density of the coolant, and hence its ability to achieve this performance is checked by a hydrometer, and should be checked prior to winter storage to protect your aircraft. If the winter temperatures fall under this value, then drain the coolant, and if required for service, refill with pure antifreeze. Because anti freeze ages, renew the cooling agent every two years. Read the engine manual for the manufacturer's recommendations. During winter flying operation the necessary operating temperature for oil and cooling agent may not be reached. It is important that the oil temperature reaches higher than 80°C to prevent engine interior corrosion from condensation, so if necessary carefully blank off a portion of the oil cooler and monitor the temperature. Don't forget to remove the blank (tape) when the weather warms up!
As an alternative to the use of temporary blanking tape on the oil cooler, an insulator may be permanently fitted to the oil thermostat. This prevents radiant heat gain from the exhaust silencer and gives better control of the oil temperature. It may be implemented under MC-156 /SB-036.
If implemented, the security of the insulator pad must be checked at each service interval.

8. EQUIPMENT

8.1 MINIMUM EQUIPMENT

The pilot must wear suitable personal clothing for the weather and flight planned – eg helmet, footwear, sunglasses, heated clothing etc.

The legally prescribed minimum instrumentation is:
- 1 airspeed indicator, measuring range 0 to 120mph (unless otherwise approved), markings such as Section 2.2
- 1 altimeter, range 3000m or 10.000ft.
- 1 compass

ATTENTION
Take care when installing additional equipment in case it changes the magnetic field of the aircraft, and hence the compass accuracy.

8.2 ADDITIONAL EQUIPMENT.

Various options are available from RotorSport UK Ltd. Do not fit unapproved accessories as these may invalidate your Permit to Fly!

REMARK
Further individual equipment is available on customer's request. This increases the take-off weight and leads therefore to a reduction of the permissible payload.
Take care if carrying luggage bags or other items in the footwell that they do not and cannot move in such a way as to restrict or impede any control movements.
The pilot may wish to consider implementation of MC-131 (Remove rear-seat rudder pedals) and/or MC-135 (minimised rear stick mountings) – refer to RSUK for further information.

8.3 Constant speed controller and Woodcomp SR3000/3 propeller option package.

The propeller is an SR3000/3/R/P/CS/C-****RS, specifically designed for the MT series application. This means that there are internal designs that make the product unique, and it must not be replaced by propeller other than the part supplied by RotorSport UK Ltd. The four '*''s indicate a three digit serial number plus the year of manufacture. At the root of each blade is a special self adhesive label stamped with the propeller serial number, the order of the blade (A, B or C) and the month/year of manufacture.

The propeller is electrically actuated via slip rings on the engine face.
WARNING! Cleanliness of this face is important, do NOT apply corrosion preventative substance to the slip rings! It will prevent them from functioning!
The propeller has two pitch limit stop systems – an electrical one, where the input voltage is switched off to the motor, and mechanical stops to limit travel in the event of an electrical switch failure. The aircraft will still climb at a minimum rate of 250fpm in full coarse, and will not over-rev in the climb in the event of full fine setting. However, it is the pilots responsibility to monitor engine rpm in the cruise and descent to ensure rpms are kept within operational limits!
Note that the propeller requires up to 5secs to transit from full fine to full coarse pitch

The Smart Avionics CSC-1/RS controller is a unique part for this aircraft, pre programmed to suit the application. Do NOT fit any other controller!

LED warning lamp
Continuous red = 5,800 reached
Continuous yellow = 5,500 reached
Yellow with red flashes = RPM has been maintained for more than 4 mins
Flashing red = RPM is below 4000, and cruise mode still selected.

RPM = engine rpm

MAP = Manifold Air Pressure "Hg
Alternatively, will show target rpm when being adjusted instead.

MODE button, to change between manual, cruise and take off (with sw in OK pos'n)

OK/Disable sw.
Disable = computer disconnected, use +/-sw to change prop pitch

Current mode

+ pitch increase
- pitch decrease

Blade pitch change. when in manual mode or target rpm in cruise or climb.

Pilots view of controller

Fuses. The controller electronics have a separate fused supply from the propeller power supply. The pop out/pull out panel mounted circuit breaker protects the propeller itself, and the panel mounted LED indicates when power has been supplied to the propeller.

These notes assume that the pilot already has some experience of operating a variable pitch propeller manually. If you are not familiar with how your propeller is operated in flight manually, it is strongly recommended that you gain some experience of manual operation before using the CSC-1/RS's constant speed modes.

The UK CAA strongly recommend pilots to undergo 'differences training' before they are allowed to operate aircraft with variable pitch propellers.

Panel fuse and pitch function lamp.
The lamp will light whenever the propeller is changing pitch. It will go out when the pitch limits are reached. In manual mode, the controller panel will show a '+' or a'-' during pitch increase or decrease until the stops are reached, & then show '+++' or '---' whilst the toggle switch is still engaged. It will show '++' or '—' when released.

The fuse guards the supply circuit to the propeller only, not the controller. If it 'pops', it means the propeller circuit has an overload. The controller will stay on, so that the engine rpm is visible.
This fuse may pop out due to air loads on the propeller or from an electrical failure. On this basis it is allowable to reset it once only. If it pops out again, then assume an electrical failure and do not reset until investigated on the ground.

Coping with Malfunctions
Coping with a controller malfunction
In the unlikely event that the controller suffers a hardware or software failure and you believe it to be untrustworthy, disable the computer control by setting the OK/DISABLE switch to the DISABLE position and use the +/− switch, or the rocker switch mounted on the left side of the front seat, to manually adjust the propeller pitch.
If the controller display fails, and you are unable to determine engine rpm or manifold pressure, then flight may continue by disabling the unit as above, and reverting to manual mode. Care must be taken to set an appropriate rpm for the flight conditions, and if at fine pitch, do not descend at more than 80mph to prevent engine overspeed.

Coping with an engine malfunction
If an engine malfunction causes the RPM to fluctuate, the controller will continuously change the propeller pitch in a futile attempt to keep the RPM constant. If this occurs, select manual mode and use the +/− switch to manually adjust the pitch to a suitable setting.

Coping with propeller malfunction.
A propeller may malfunction giving the following scenarios:
1. Propeller runs to fully coarse and stops. Probable cause; jammed switch (in manual mode) or controller fault (auto mode). If in controller mode, switch to manual control. If no effect, make precautionary landing.
WARNING, the climb rate will be reduced to 250fpm minimum! Also, at fully coarse, the engine will be under increased load at low rpm. Take care as if power is set to idle, it could result in an engine stall.
2. Propeller runs to fully fine and stops. Probable cause; jammed switch (in manual mode) or controller fault (auto mode). If in controller mode, switch to manual control. If no effect, make precautionary landing. Note that fully fine could result in engine speed over run if taken to max power in level or descending flight! Set engine rpm 5000 maximum at 80mph.
3. Propeller pitch oscillates. Probable cause, faulty controller. Switch to manual mode and set pitch to suitable setting for continued flight. Investigate on landing.
4. A propeller blade pitch becomes different to the others (jammed or gear stripped). Probable cause, internal mechanical failure. This will result in significant warning vibration. Manual pitch adjustment to match pitch angle may be possible – then reduce power and make a precautionary landing. Otherwise turn off engine & make immediate precautionary landing.
5. Loss of blade. This will result in severe vibration. Switch engine off and land immediately.
6. Loss of tip. This will result in significant vibration. Switch engine off and land immediately.

7. Loss of complete unit. This could result in destruction of the tail or other structural damage Switch engine off and land immediately.
8. Loss of controller display. Probable cause; controller internal failure or fuse blown (1amp). Revert to manual control and maintain aircraft speed and propeller pitch at around 80mph to prevent engine overspeed.
9. 10amp CB pops (cuts power supply to propeller via controller) Controller display will remain on, but pitch change lamp will not light. Reset once only. If it pops again, make a precautionary landing to investigate, or, if the propeller pitch versus engine rpm is appropriate for continued flight, continue to destination.
10. 25amp panel fuse blows. This cannot be changed in flight. Loss of power supply to propeller (and full instrument panel). No pitch change possible, prop will remain at last pitch setting. Make precautionary landing if unsafe to continue the flight.

Note – an increase in vibration from the engine area should always be investigated at the earliest opportunity. Typical causes are (but not limited to): loose engine mounting bolts to airframe or to the engine bearer, loose propeller, incorrect pitch setting (blade to blade, as set or from jamming), or blade damage. After the instance of such vibration the engine and airframe should undergo a detailed examination for subsequent damage. Refer to RSUK for guidance.

Recommended Usage of Controller
The following sections suggest how the controller should be used in various phases of flight. Remember, at any time, manual mode can be selected and the pitch controlled manually.
This would be appropriate when carrying out manoeuvres that involve rapidly changing airspeed e.g. stalls or flying in very rough air.

Engine start
When starting the engine, the OK/DISABLE switch can be in either position. Until the engine is running, pressing the MODE button will not change the controller's mode but it will make the controller display the current mode, pitch and manifold pressure instead of the total engine hours.
Before you start the engine, it is a good idea to make sure that the propeller pitch is not particularly coarse. This will reduce the load on the engine while starting and idling. If necessary, reduce the pitch using the +/− switch. However, unless the pitch has been manually changed, it is likely to be still fine from the previous landing. As soon as the engine runs, the current RPM will be displayed.

Runup
For the engine runup, the propeller pitch should be fairly fine. This can be achieved either by selecting manual mode and adjusting the pitch using the +/− switch or by selecting climb mode. It is likely that the propeller pitch will still be fine from the previous landing. Make sure the brakes are applied.

Takeoff
For takeoff, select climb mode (by pressing the MODE button for at least 1 second) as part of the pre takeoff checklist and verify that the pitch display indicates that fully fine pitch has been achieved. When climb mode is selected, the climb mode target RPM is set to the preset value and displayed for a few seconds.

If desired, use the +/− switch to adjust the target RPM.
When the throttle is opened, check that the static RPM rises to a sensible value. The exact figure will depend on the position of the propeller's limit stop but should be around 5000 RPM. The RPM

should quickly rise as the aircraft accelerates. When the RPM exceeds the climb mode target RPM (+ dead band), the pitch will automatically be coarsened to bring the RPM back into the dead band. This automatic 'gear changing' can be slightly unsettling at first because the pilot may not be used to hearing the RPM changing quickly without their intervention.
If there is a strong wind gradient, the RPM may increase quickly as the aircraft flies through the gradient. In this situation it is possible that the maximum allowed RPM will momentarily be exceeded if the target RPM is high (say 5700). To avoid this, the target RPM is set at 5600 as the default each time the unit is turned off or mode changed. Strong gusts and turbulence can have the same effect, so unless essential, leave the target setting at 5600.
The target RPM may be altered at any time in the climb using the +/− switch, not exceeding the maximum allowable of 5700.
If the target RPM is greater than the maximum continuous RPM, care must be taken not to exceed the high RPM time limit specified by Rotax. To alert the pilot to the possibility of the time limit being exceeded, the controller flashes the RPM! indicator red when the RPM has been above the yellow line RPM for more than 4minutes.

It is the pilot's responsibility to ensure that the recommended time limit is not exceeded.
Throughout the takeoff and climb out, the pilot should concentrate on airmanship and accurate flying; very little thought has to be given to the controller.

Climb
To enter a climb while cruising, the following sequence of actions should be carried out:
1. raise the nose to start the climb
2. as the airspeed reduces, engage climb mode
3. progressively open the throttle to the desired setting

The amount of time between raising the nose and engaging climb mode depends on how fast the aircraft was cruising. If the cruise airspeed is low, engage climb mode at the same time as the nose is raised and start opening the throttle immediately afterwards. To reduce the chance of over revving the engine, avoid quickly opening the throttle whenever the airspeed is high.
The target RPM in the climb may be adjusted using the +/− switch.

Note
Although the switch actually adjusts the target RPM, it is labelled in terms of propeller pitch adjustment, so pressing it towards + increases the pitch and reduces the RPM (and vice versa). This may seem confusing but it is consistent with how the +/− switch is used to adjust the pitch in manual mode.

Cruise
When the aircraft, in climb mode, reaches the required cruising level, select cruise mode by pressing the MODE button briefly. Simultaneously, adjust the throttle to the desired power level. The airspeed is then controlled by the throttle. The target RPM can be adjusted using the +/− switch as described above.
Gentle climbs and descents can easily be made in cruise mode without adjusting the throttle as the controller will adjust the pitch appropriately when the airspeed changes. As a climb is steepened, the propeller pitch will be reduced to maintain the RPM.
As a descent is steepened, the propeller pitch will be increased to limit the RPM. At some point, the propeller will become fully coarse and the RPM will continue to rise if the airspeed is not reduced. The pilot can either reduce the throttle setting or reduce the rate of descent.

If the air is very turbulent, the controller may adjust the propeller pitch a lot more frequently than normal. In this situation, it is better to select manual mode and suffer the RPM changes rather than overworking the propeller pitch change mechanism.

Descent
When descending, reduce the throttle as normal and, if necessary, change the controller mode. For example, when descending from the overhead to circuit height, you can keep cruise mode selected as this is appropriate for the downwind leg.
When descending on base leg, select climb mode so that you will be ready for a possible go around.

Approach
Ensure that climb mode has been selected by the time the approach starts and check, with a couple of glances at the LCD display, that within a few seconds the propeller has gone fully fine and that the RPM is reasonable given the airspeed and the throttle setting.

Engine shutdown
The controller can be in any mode and the OK/DISABLE switch can be in either position when the engine is shutdown.

Limitations
The pilot should be aware of the following limitation of the controller:
Electrically operated variable pitch propellers cannot react quickly enough to stop the red line RPM being exceeded if the propeller pitch is too fine for the current airspeed and the throttle is opened quickly.
To reduce the chance of this occurring, avoid quickly opening the throttle, especially when the airspeed is high and the propeller pitch is fine.

Performance.
Climb performance with the SR3000/3 propeller.
914UL 650fpm at 5,600rpm, 500Kg MTOW
912ULS 450fpm at 5,600rpm, 500Kg MTOW

Appendix 1 Change of ownership form

<table>
<tr><td colspan="3">This form is supplied to enable the new owner to register the change of ownership, so that he/she may receive any service or other information relating to the aircraft.
The information is stored on a computer, and is only used within RotorSport UK for the above purpose.

If the new owner does not register, then they will not be automatically updated, which may lead to unsafe flight or an un-airworthy aircraft.</td></tr>
<tr><td colspan="3">Return this form to:
RotorSport UK Ltd, Poplar Farm, Prolley Moor, Wentnor, Bishops Castle, Shropshire, SY9 5EJ
Or email info@rotorsport.org, or fax 01588 650769</td></tr>
<tr><td>Aircraft type</td><td colspan="2">Aircraft serial No.</td></tr>
<tr><td>Aircraft Registration No.</td><td colspan="2">Aircraft Engine No.</td></tr>
<tr><td>Logbook Aircraft hours</td><td colspan="2">Logbook Engine hours</td></tr>
<tr><td colspan="3">Old owners name and address

Signature & date</td></tr>
<tr><td colspan="3">New owners name and address

Signature & date

Email:</td></tr>
<tr><td colspan="3">RSUK Office use only</td></tr>
<tr><td>Date entered onto database</td><td>Acknowledgement sent (date)</td><td>Job completed by:</td></tr>
</table>

Form F024

Appendix 2 Incident reporting form

<table>
<tr><td colspan="3">This form is supplied to enable the owner/operator to inform (anonymously if needed) RotorSport UK Ltd of any incident, accident or other field or service failure that they feel appropriate. The owner must also, of course, inform the relevant authorities if that is appropriate – eg Air Accident Investigation Branch etc.
Depending on the incident information supplied, a corrective action is investigated and, if needed, supplied back to the customer(s)

The information given is stored on a computer, and is only used within RotorSport UK for the above purpose.</td></tr>
<tr><td colspan="3">Return this form to:
RotorSport UK Ltd, Poplar Farm, Prolley Moor, Wentnor, Bishops Castle, Shropshire, SY9 5EJ
Or email info@rotorsport.org, or fax 01588 650769</td></tr>
<tr><td>Aircraft type</td><td colspan="2">Aircraft serial No.</td></tr>
<tr><td>Aircraft Registration No.</td><td colspan="2">Aircraft Engine No.</td></tr>
<tr><td>Logbook Aircraft hours</td><td colspan="2">Logbook Engine hours</td></tr>
<tr><td>Pilot name</td><td colspan="2">Passenger name</td></tr>
<tr><td colspan="3">Incident (please include extra sheets as needed, and be as precise as possible)</td></tr>
<tr><td>Incident location and date</td><td colspan="2">Aircraft loading condition (inc fuel)</td></tr>
<tr><td colspan="2">Weather conditions</td><td>Sheet of</td></tr>
<tr><td colspan="3">Reporting persons name and address

Email:

Signature & date</td></tr>
</table>

Form F025